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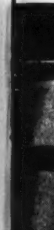

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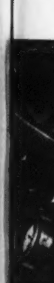

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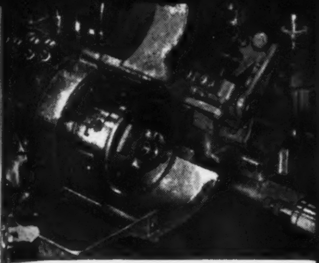
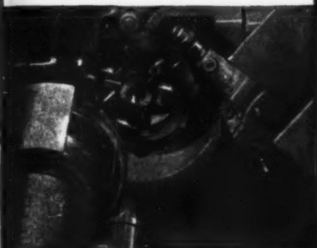
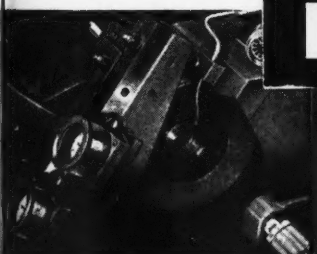


Heald 171 Size-Matic Internal grinds I.D.'s of two different size gyro rotor assemblies AS WELL AS two different I.D.'s in a rotor support frame.



Combination set-up on a 171 Gage-Matic with a slide bar facing attachment for SIMULTANEOUS bore and face grinding of cam seam rollers.



Slide bar boring attachment on a Heald 171 Size-Matic Internal ensures CONCENTRICITY between ground stator bore and housing diameters of stator and housing assembly within 0.00005in.

HEALD

Model 171
Internal Grinding Machine
now being built in Birmingham

This latest addition to the range of British Built Heald Internal Grinding & Boring Machines can bring you greater return on investment. Available in Size-Matic or Gage-Matic styles, the Heald Model 171 is a precision internal grinder for high volume production with completely automatic grinding cycles.

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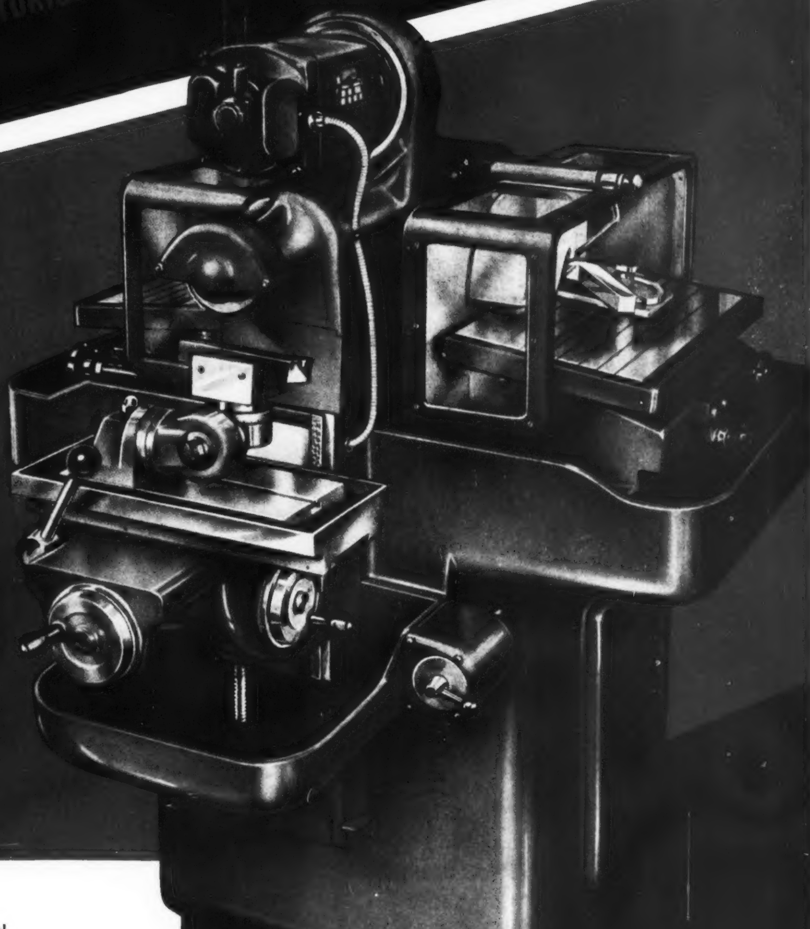

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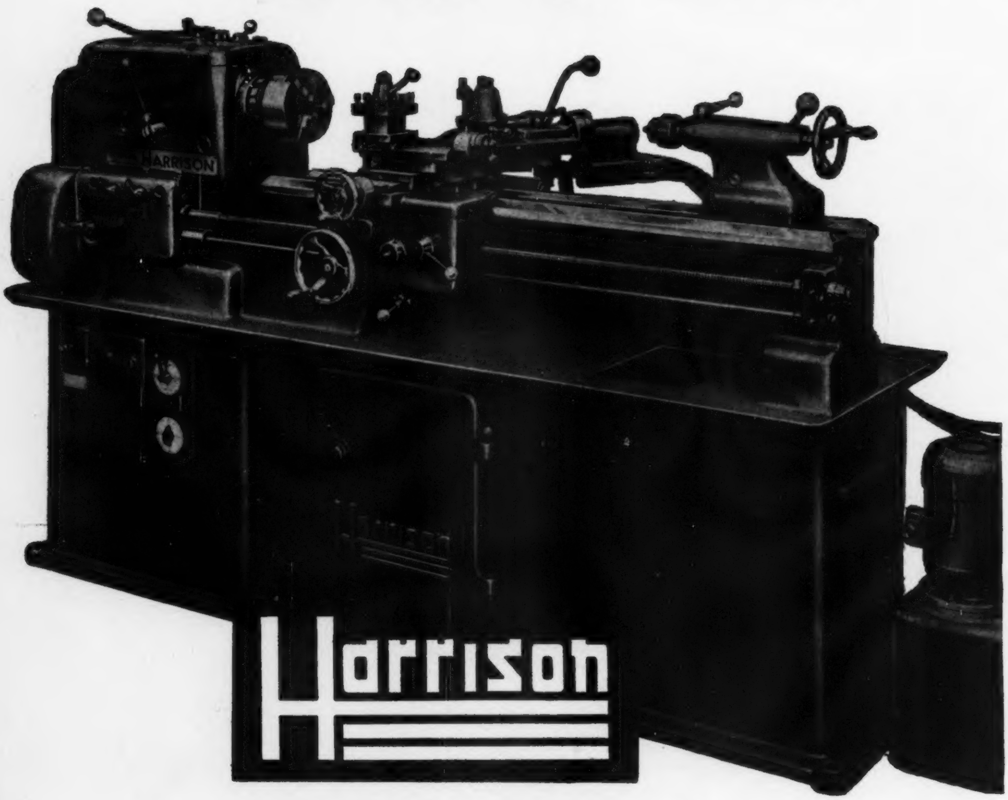

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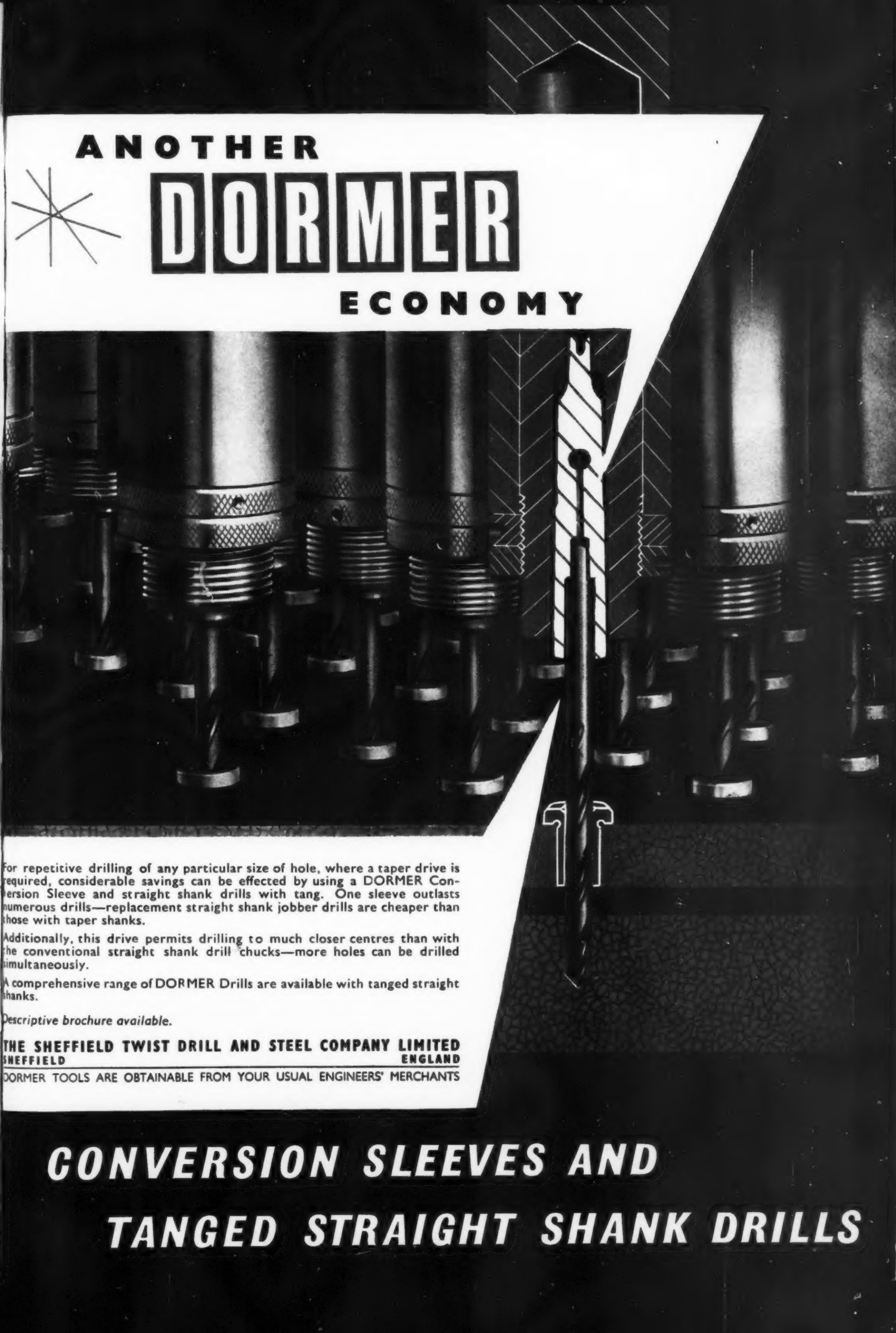
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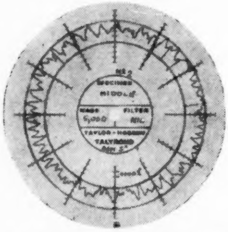

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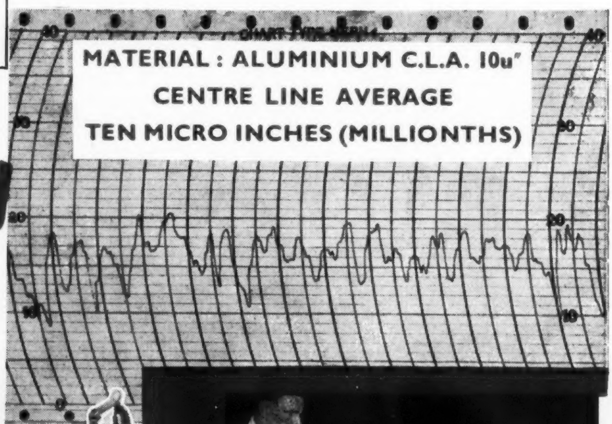
the advantages of "fine boring" techniques

techniques are now universally accepted by progressive firms.

By running the cutting tool at its maximum cutting speed, time is saved, and accuracy and finish greatly improved. Hitherto such machines were limited to light cuts and fixed centre heights: this is no longer so. The Milnes Heavy duty boring machine has overcome these limitations, and has extended the application to a wide range of general engineering components either as one offs or batches of thousands. The machine is capable of roughing castings with cuts up to ½in. deep, and spacing accurately any number of bores. It is robust, dependable and easy to operate, and can be profitably employed in all modern machine shops.



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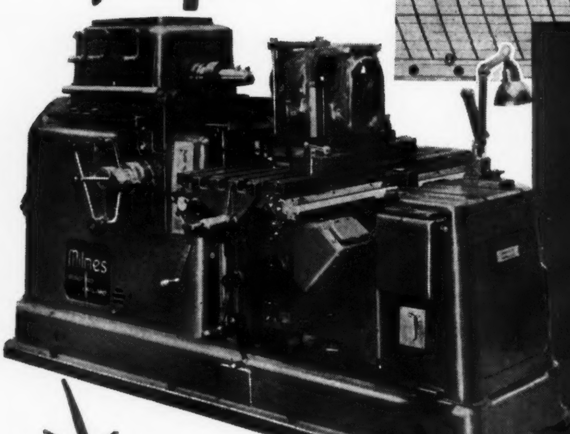

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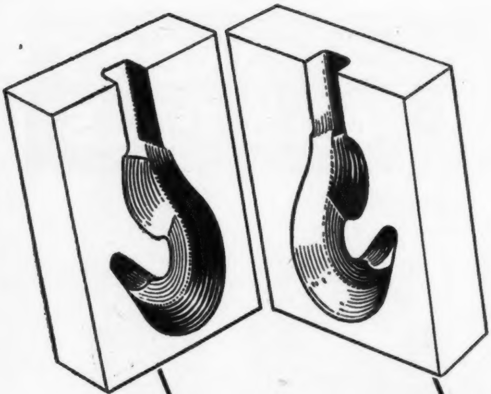
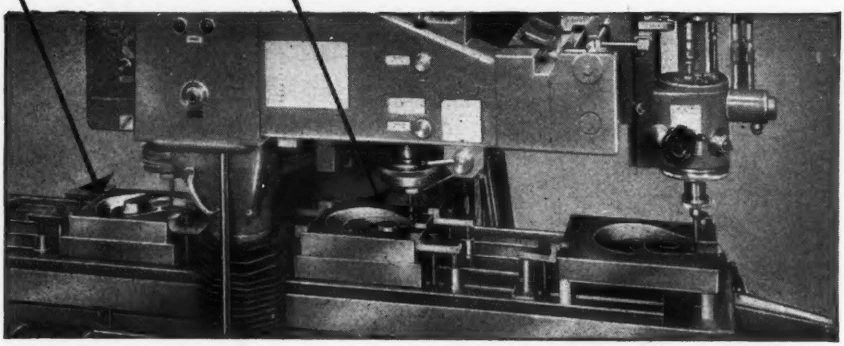


Both halves at once



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Reverse image attachment copy mills both left- and right-hand die halves at the same time from the same model. Copying is accurate to within .002″, fully automatic and needs no supervision. 360° profiles can be produced without using a rotating table and feed is constant—*and* on vertical contours up to 90°. Light feeler pressure permits the use of wooden or plaster models.

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4" DIA. SPINDLE
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AMPLE POWER FOR HEAVY DUTY MILLING

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Spindle motor	20 h.p.	25 h.p.
Spindle speeds (45)	10-1300 r.p.m.	7·5-975 r.p.m.
Max. table cross travel	132"	132"

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BY SACK & KIESSELBACH

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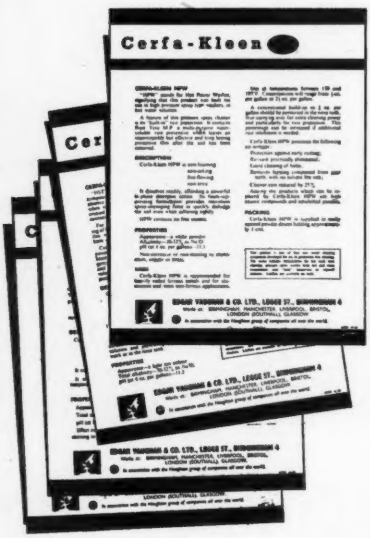

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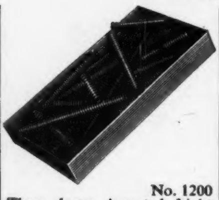

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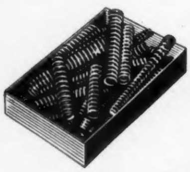
Three dozen Assorted Light Expansion Springs, suitable for carburettor control, etc. 13/6.



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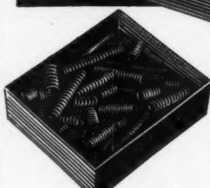

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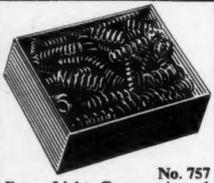
Three dozen Assorted 1" to 4" long, 1/2" to 3/4" diam., 19G to 15G. 5/6.



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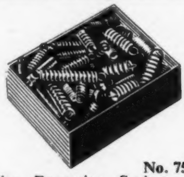

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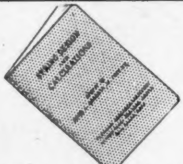

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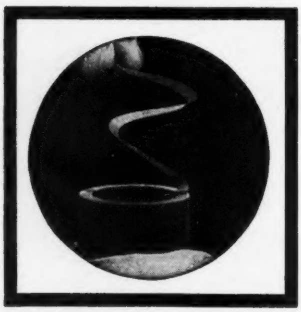

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Tecalemit Ribbon Elements filter to maximum purity

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(incorporating Tecalemit Ribbon Filter Elements)

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Tecalemit Breathers act as ventilators to provide a free flow of clean air to hydraulic fluid, fuel and oil reservoirs. They give positive protection from airborne contamination to tanks, pumps, valves, cylinder and other engine components.

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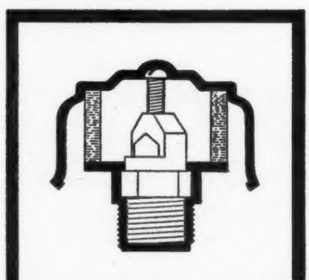
Tecalemit Breathers provide pure air cheaply and efficiently



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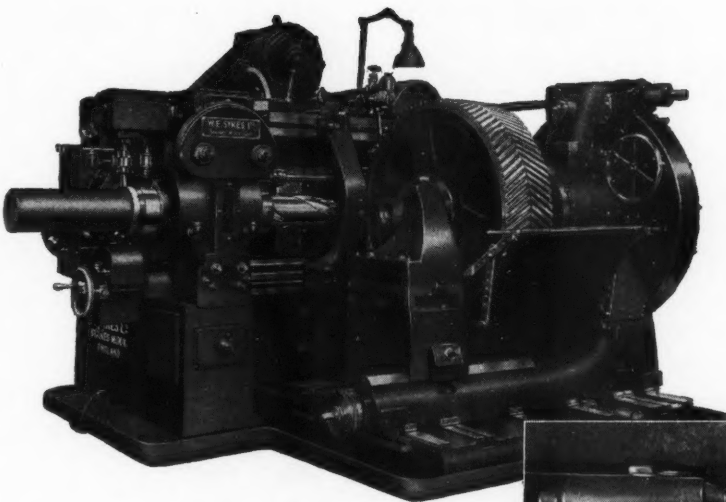
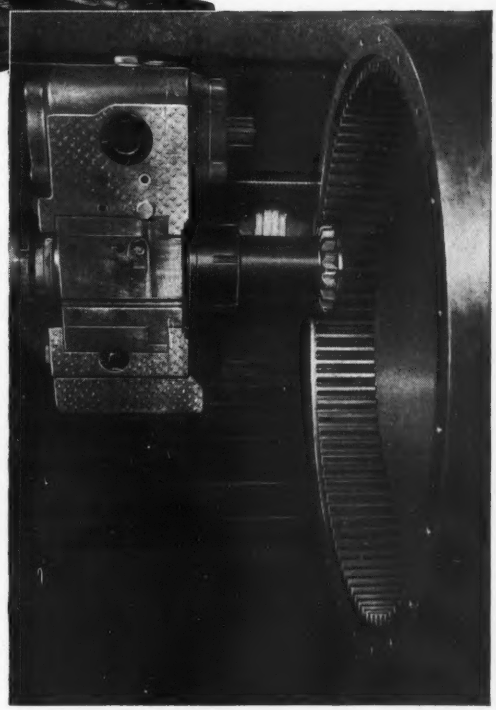


Capacity 63 in. blank diameter, 16—1½DP, 18 in. face width.



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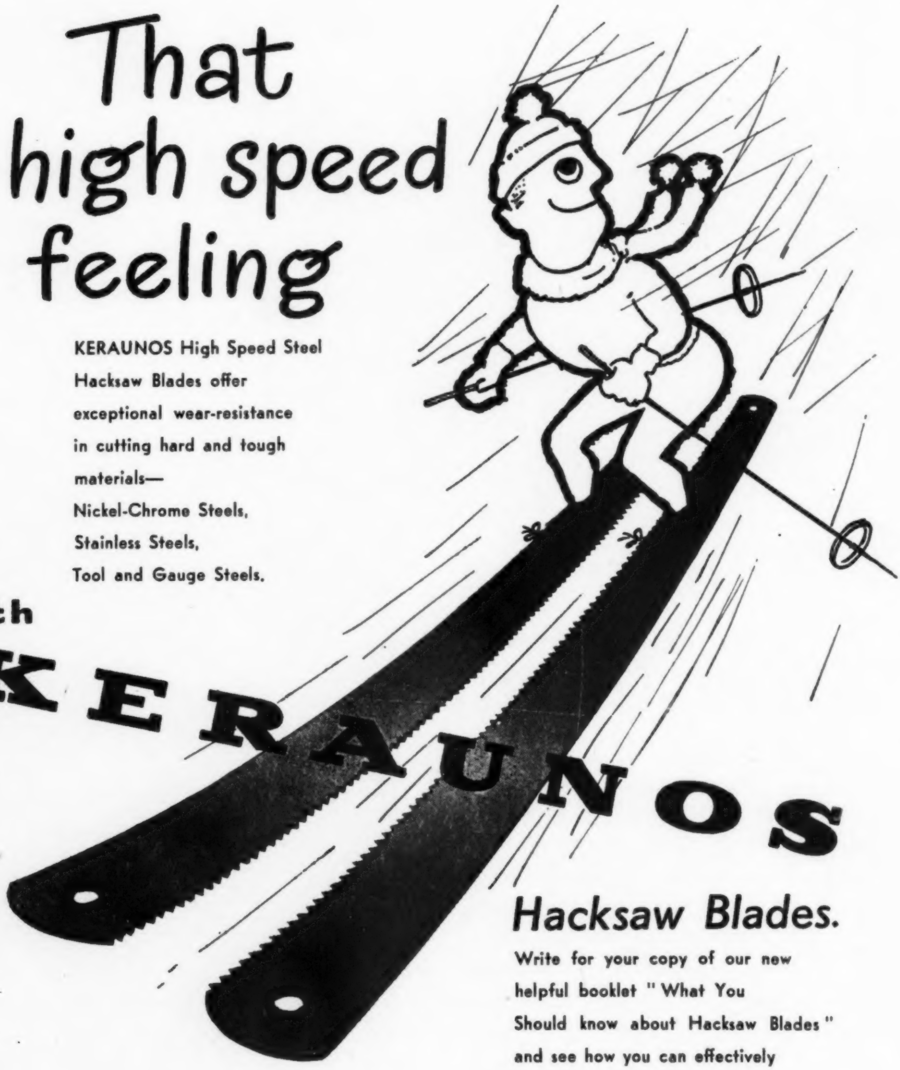

KERAUNOS High Speed Steel Hacksaw Blades offer exceptional wear-resistance in cutting hard and tough materials—
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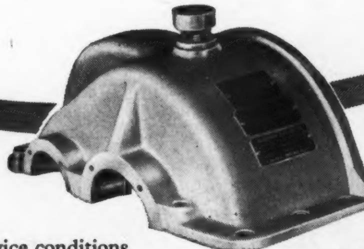
Dependable Geared Motor Drives

For arduous duties



Top half of casing is easily removed without disturbing either gears or motor. Pinions, wheels, bearings readily accessible for inspection. Handy window-type oil level indicator.

AEI Type RGD

HELICAL GEARED MOTOR UNITS

- Rugged design for arduous service conditions
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- Integral construction of motor and gearbox
- Easy installation and minimum maintenance

GEARS The oil-immersed helical gears are precision made and have efficiencies in excess of 98%

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The lower priced AEI TYPE RSD Straight Spur Geared Motor Units are offered for normal duty. Three gearbox sizes. Motors are 4-pole KVN B.S.D. machines, totally enclosed fan-cooled, or drip-proof.

Please write for full details of these units. Our specialists will be glad to give you expert advice.

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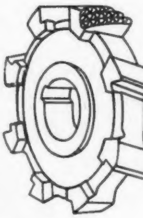
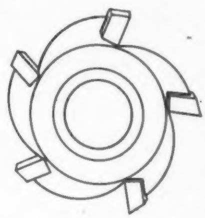
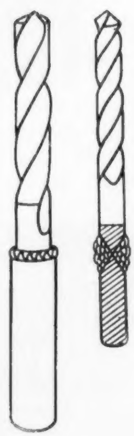


(left) "ToolTectic" alloys used to deposit HSS on mild steel blank forming cutting tools and (below) thin-flowing high-silver alloys in paste and rod form used to mount carbide tips.

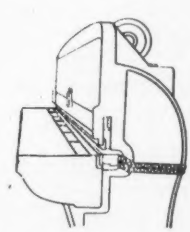




HERE'S WHY!

Cast iron, steel, spring and other alloy steels, stainless steel, nickel, copper, brass, bronze, aluminium and magnesium alloys and zinc die castings can be repaired, or overlayed to minimise wear with Eutectic Alloys.

(left) Special alloys used for joining low and medium carbon, and high alloy steels and (below) repairing heavy machine castings in position. Knife blades and dies can be rebuilt with wear-resisting 'DurChrom' alloys.



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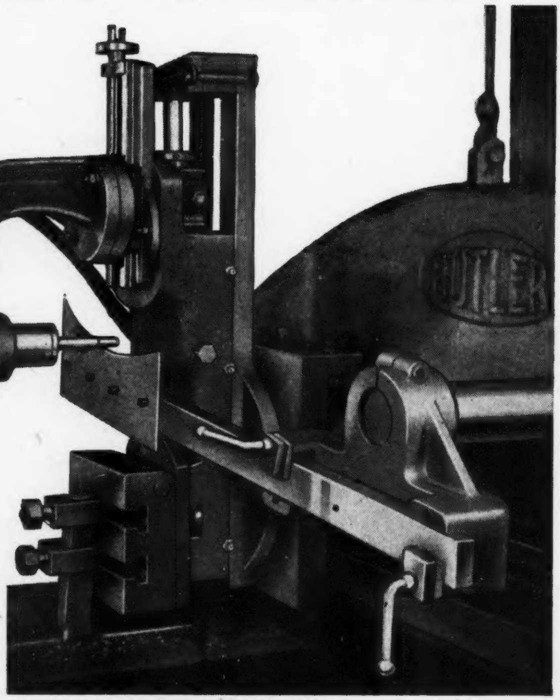

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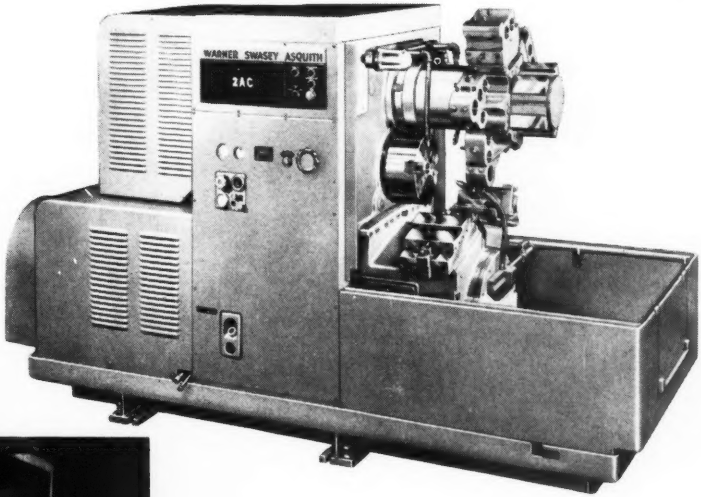
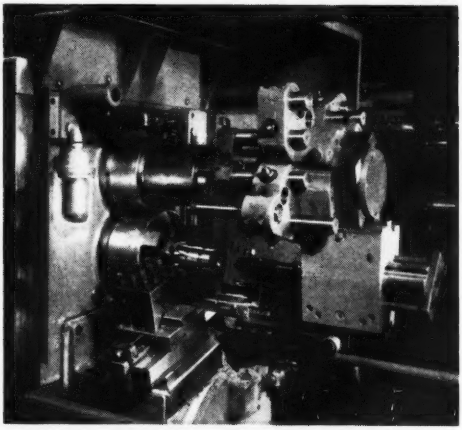
Sets up fast—Like a turret lathe



2AC

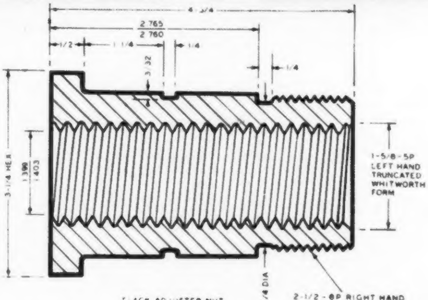
Single Spindle
Chucking Automatic



Ease and Speed of Setup, Fast Automatic Operation and Extreme Precision—these are the highlights of the Warner Swasey Asquith 2AC Single Spindle Chucking Automatics. With "No Cams to Change" it has the advantage of automatic operation without the usual time consuming setup procedure. The pentagonal control drum equipped with adjustable trips selects, feeds, speeds and length of cutting stroke. Permanent cams are used for the turret and cross slides and these two mechanisms eliminate all cam changing.

On the left is a typical production example—a manganese bronze adjuster nut, completed, including both threads, in one operation on the 2AC.

Write today for a catalogue describing the Warner Swasey Asquith 2AC.



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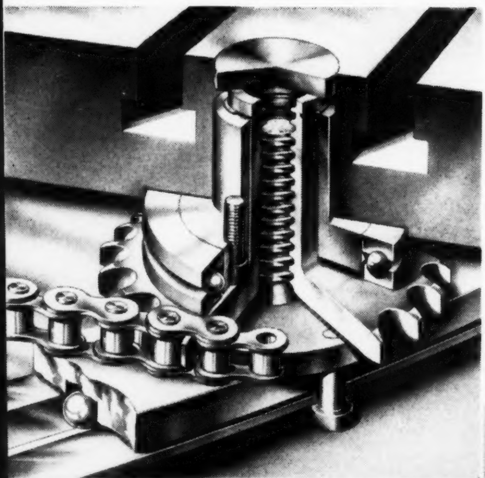
an even lift for offset loads



A screw and nut arrangement draws a precision roller chain round several sprockets. Each sprocket forms part of a carefully placed jack lift which transmits the load to a large diameter ball track and lifts the revolving table clear of the main table.

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* An even lift is ensured by a number of equal stroke "jacks".
* Several lifting points ensure good load distribution.
* Rotation under rolling friction on a large diameter ball track.

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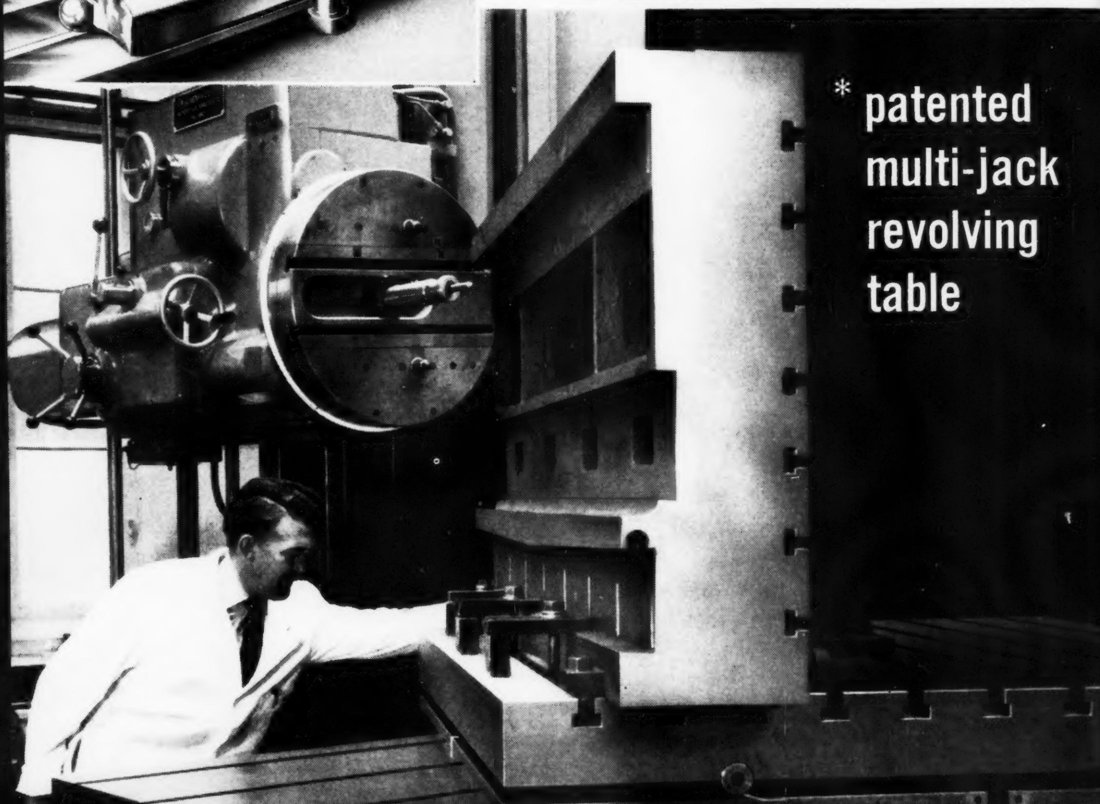

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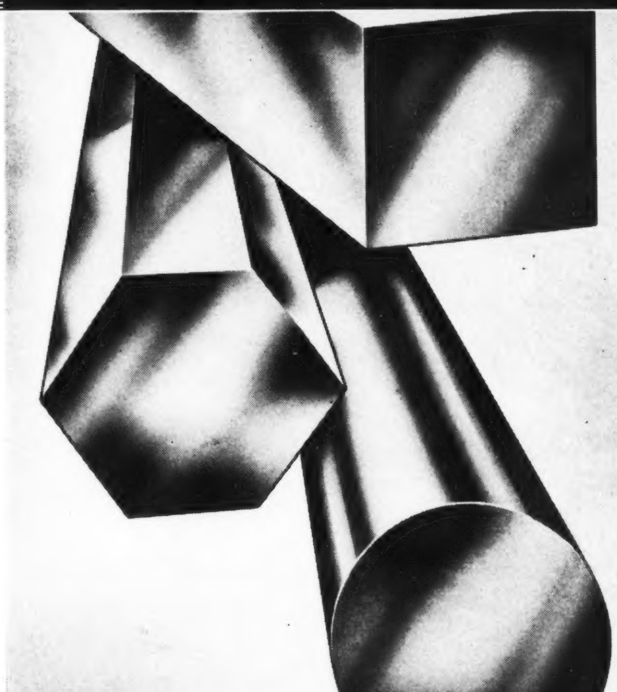

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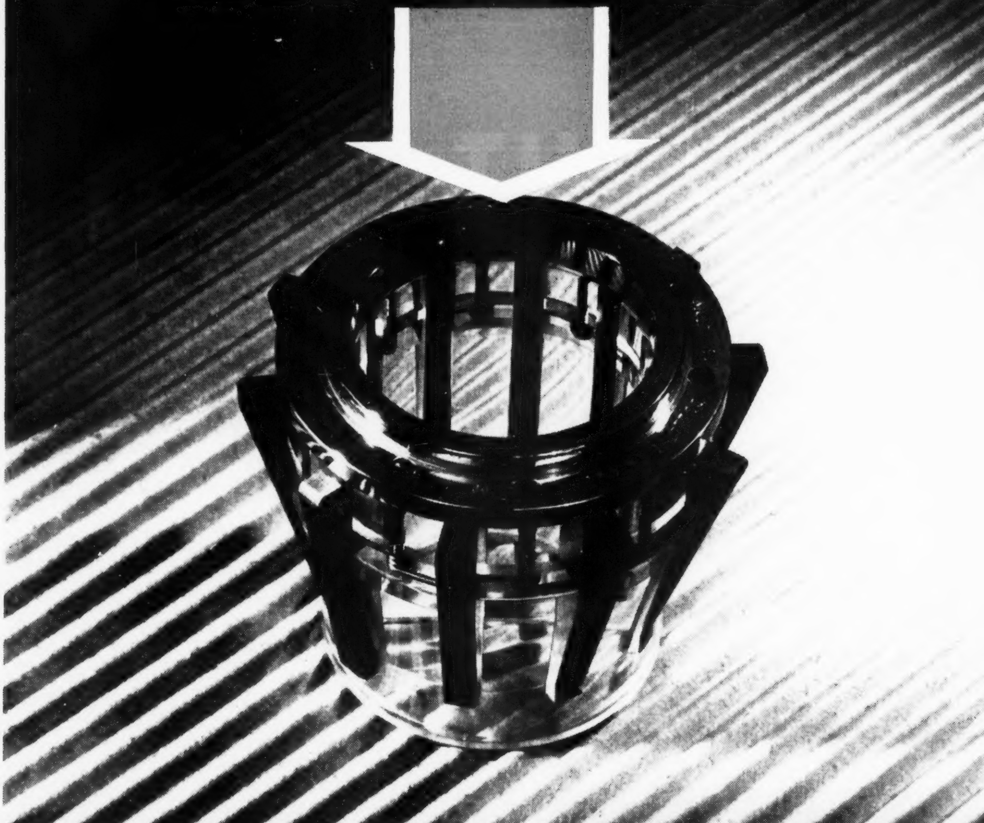
this is a "multisize" collet



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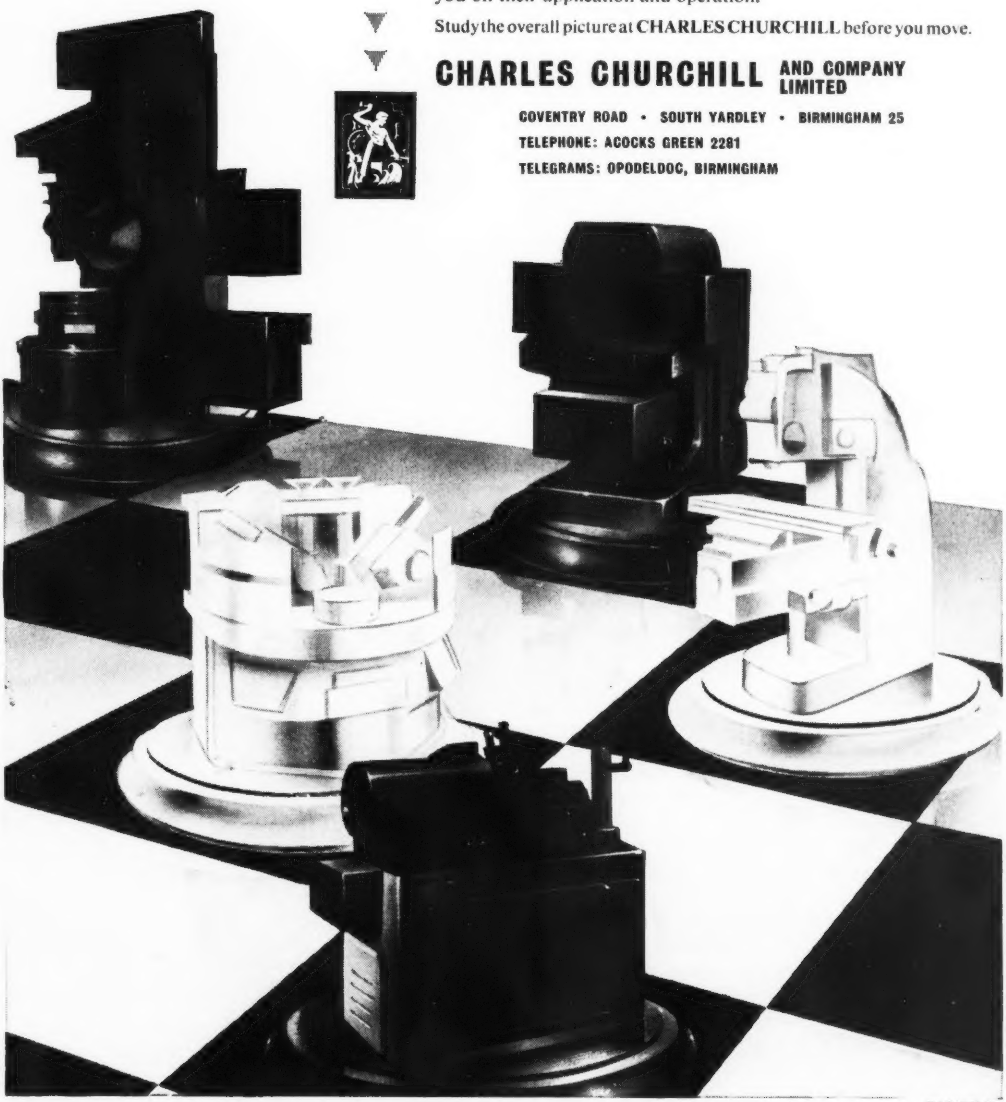

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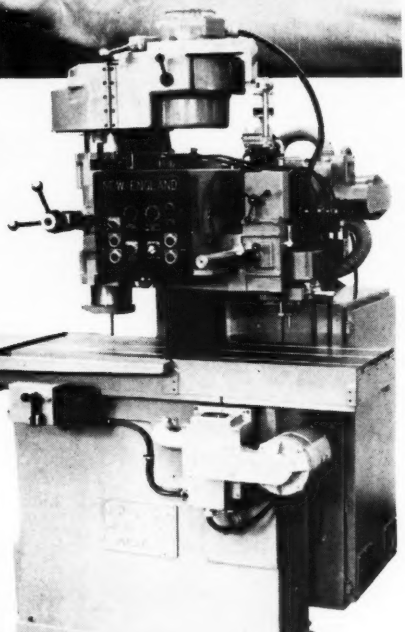

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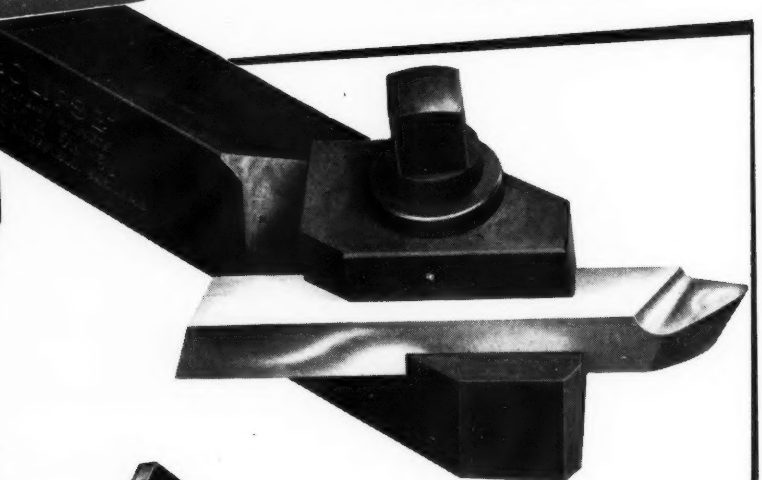
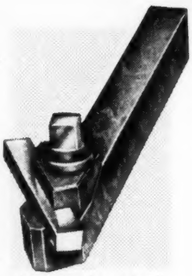
with precision features





Right-hand tool holder

Straight tool holder

Left-hand tool holder

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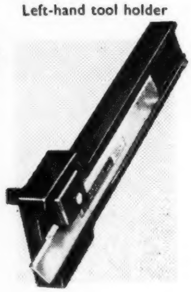
ECLIPSE TOOL BITS to make the perfect cutting combination

. . . . No ordinary tool holders, these! They have patented clamps with sideways and downwards pressure for the firmest grip. The tool seating is precision machined and openly accessible for easy cleaning, thus giving perfect tool seating and eliminating vibration which may lead to "chatter". "ECLIPSE" are precision holders for precision work and with "ECLIPSE" Tool bits they offer the finest combination for speedy and accurate production.

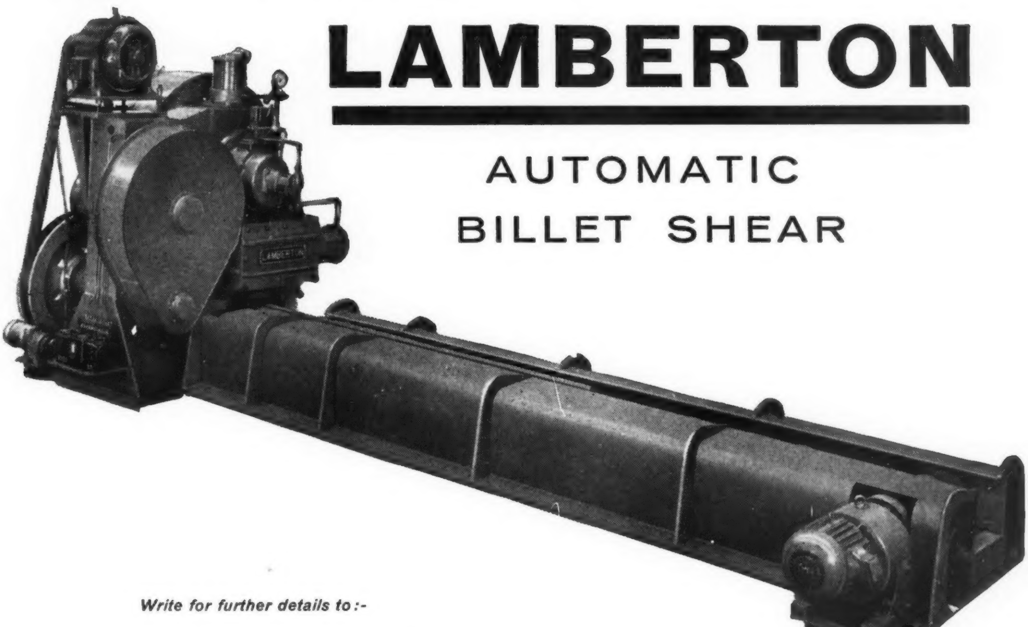
American type for slotted pillar tool post



Cutting off tool holder

Made by James Neill & Co. (Sheffield) Ltd., and obtainable from all tool distributors

UTH2



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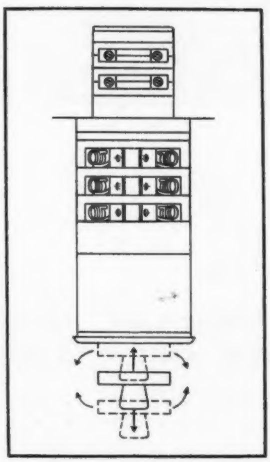
Push or pull to turn Interlocks
Push/pull Auxiliary Contacts



In addition to the normal switching sequences by rotary movement, the operating handle may be pushed or pulled from its rest position against a spring return, by which N/O or N/C contacts are closed or opened. Thus the unit is not only a selector switch, but also a push-pull device. The interlock section can be arranged to prevent the handle from being pushed or pulled in any selected position, or to prevent rotation in any particular level.

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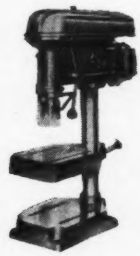

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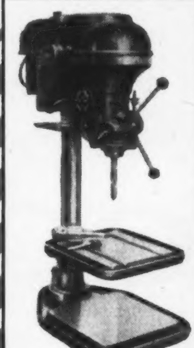

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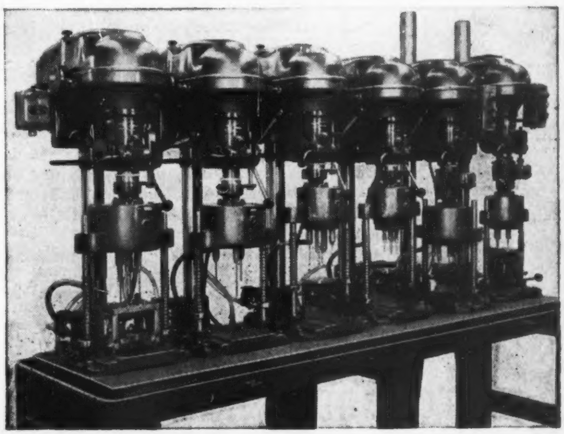

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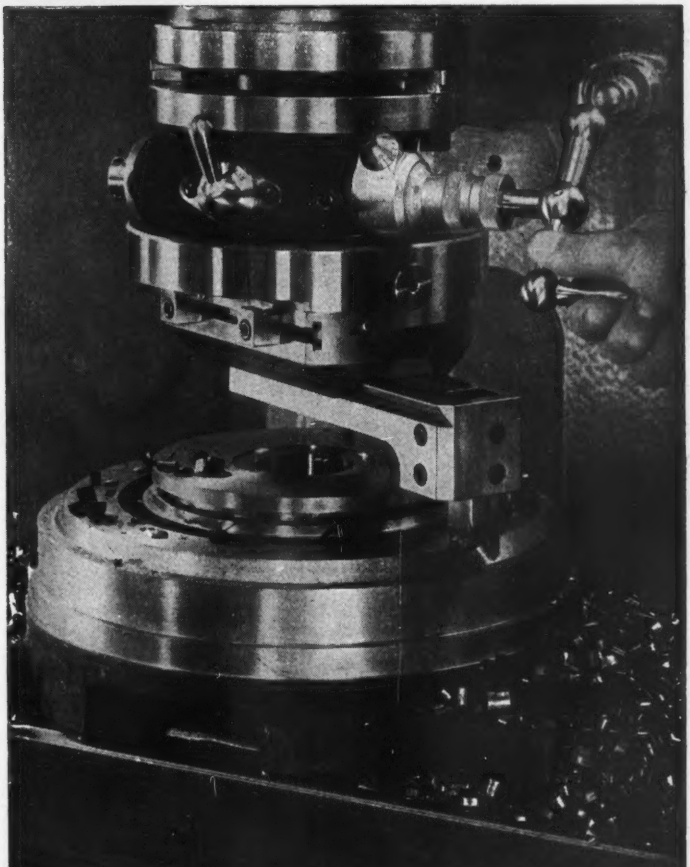

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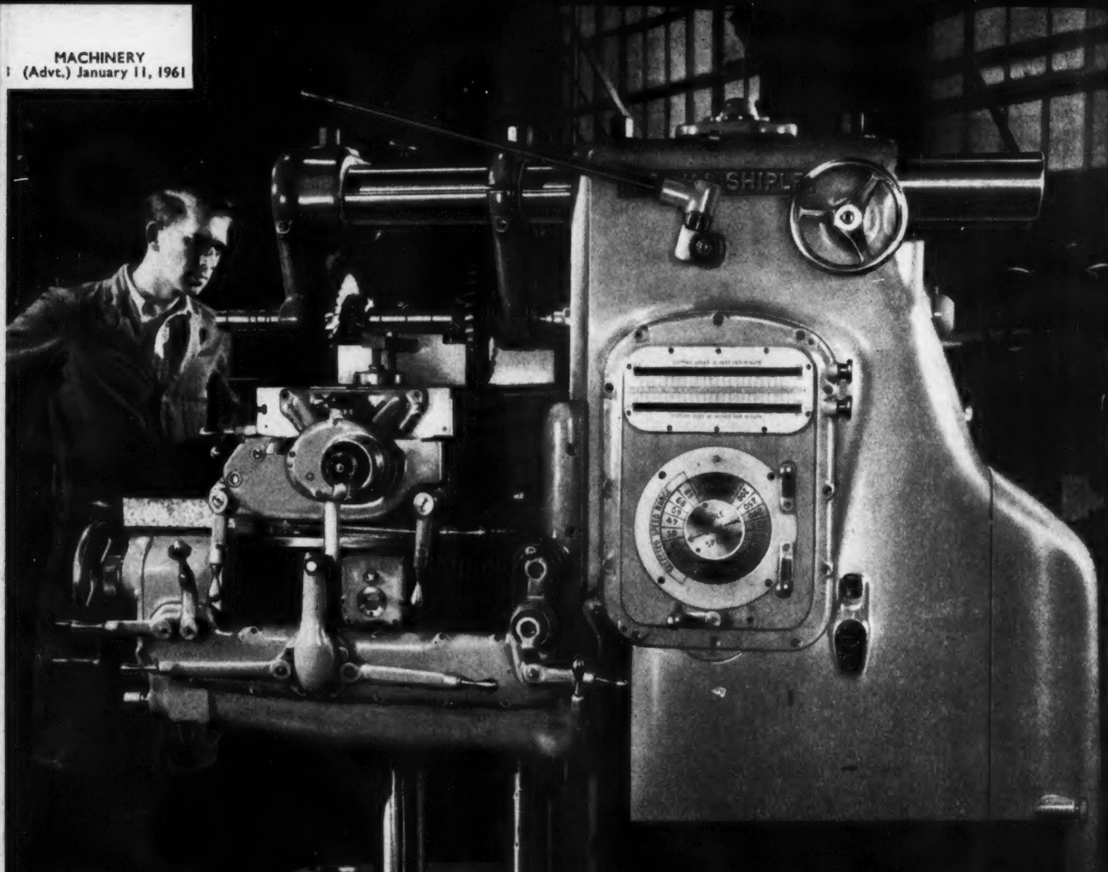

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- ✓ Positive backlash eliminator
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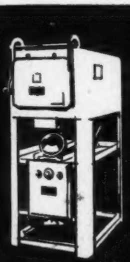
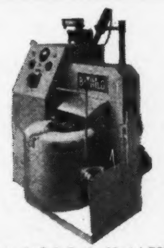
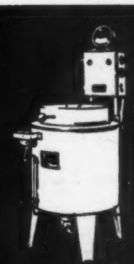




Electrode Salt Bath. Model ESB 69



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Your older machines can produce to .00005″ tolerances with the continuous reading 'Deltameter'

The Johansson 'Deltameter' provides a continuous dimensional check during manual or automatic grinding operations. Operating from any factory air supply above 25 p.s.i. pressure, the 'Deltameter' provides an immediate dimensional check while the component is being produced. Electrical contacts operate a coloured light signal system, or provide automatic control through a relay unit.

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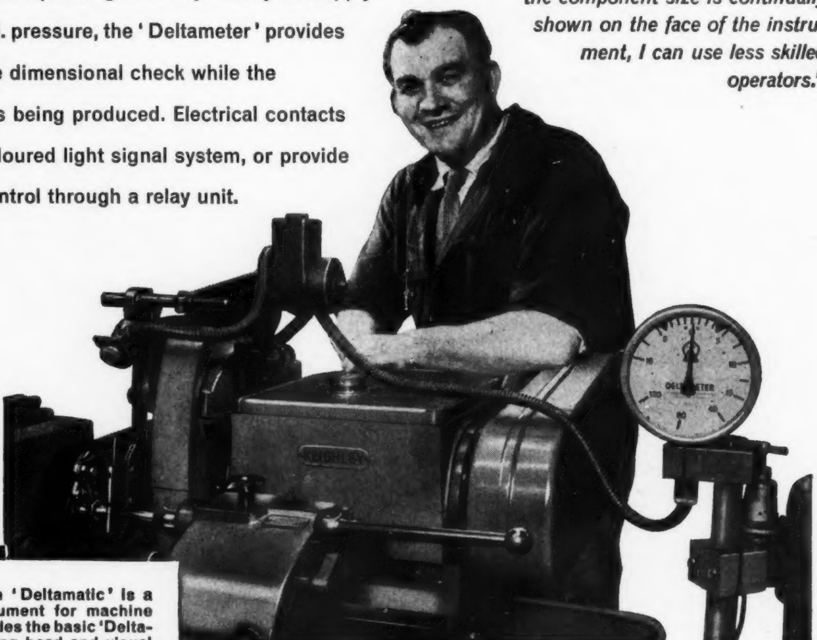
"'Deltameter' installations brought older machines into operation again, eliminated rejections, and saved hours of manual checking by conventional methods. What's more, as the component size is continually shown on the face of the instrument, I can use less skilled operators."



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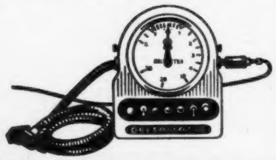

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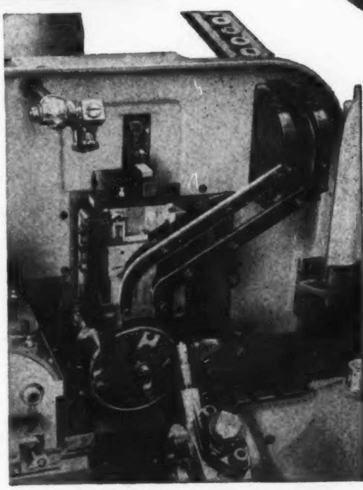

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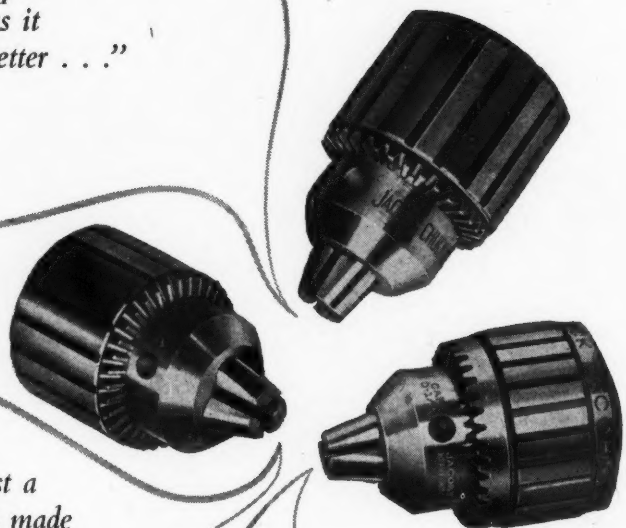

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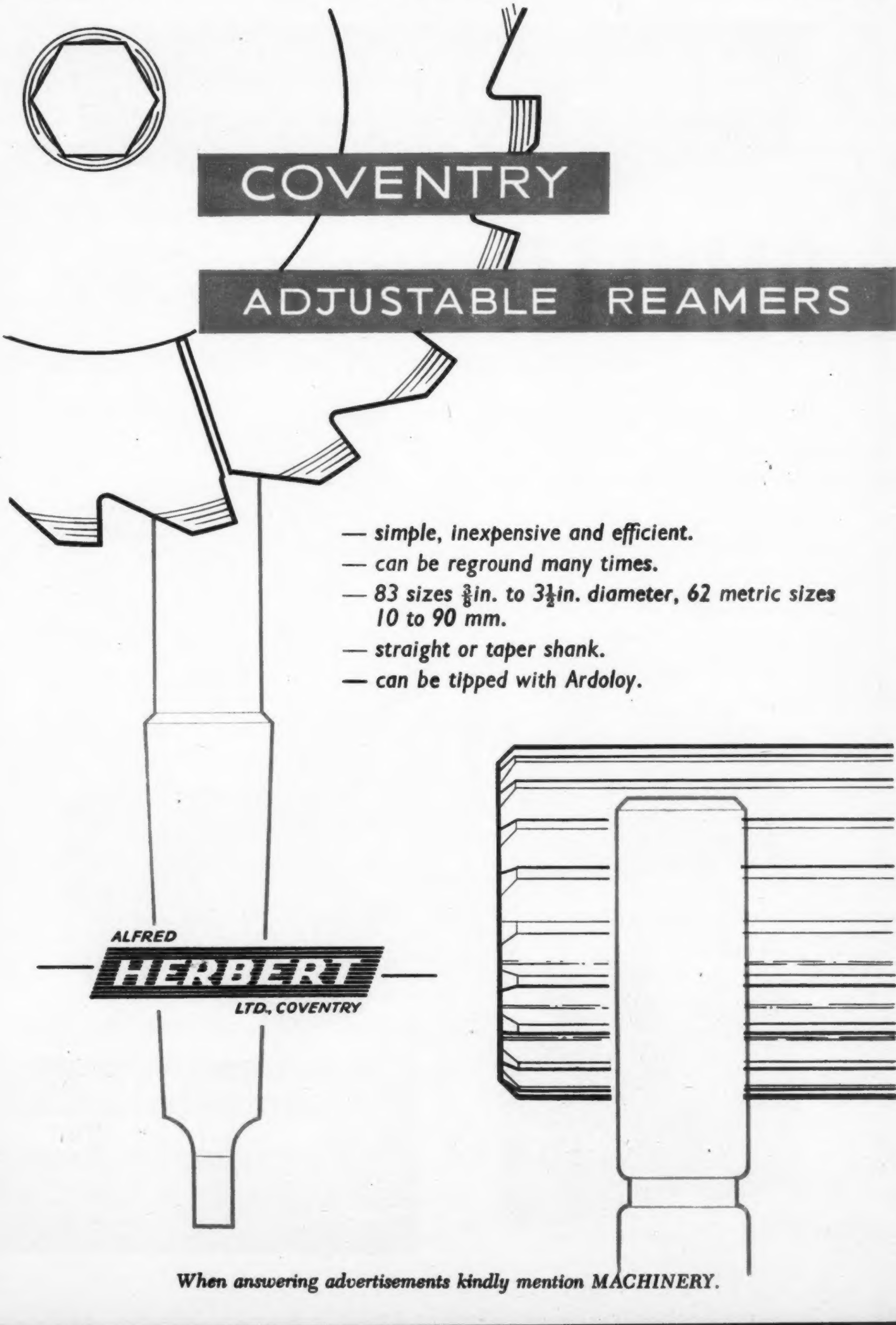
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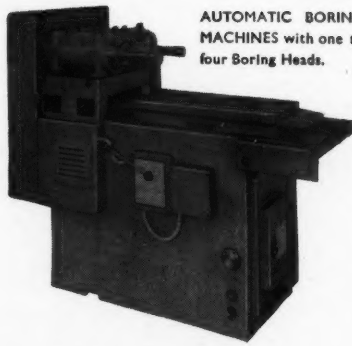

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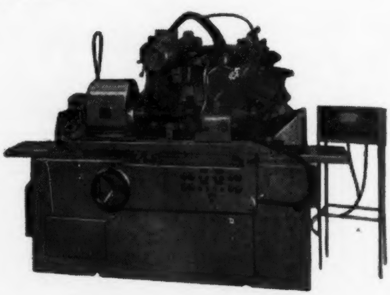

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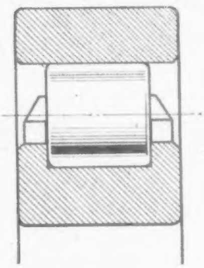

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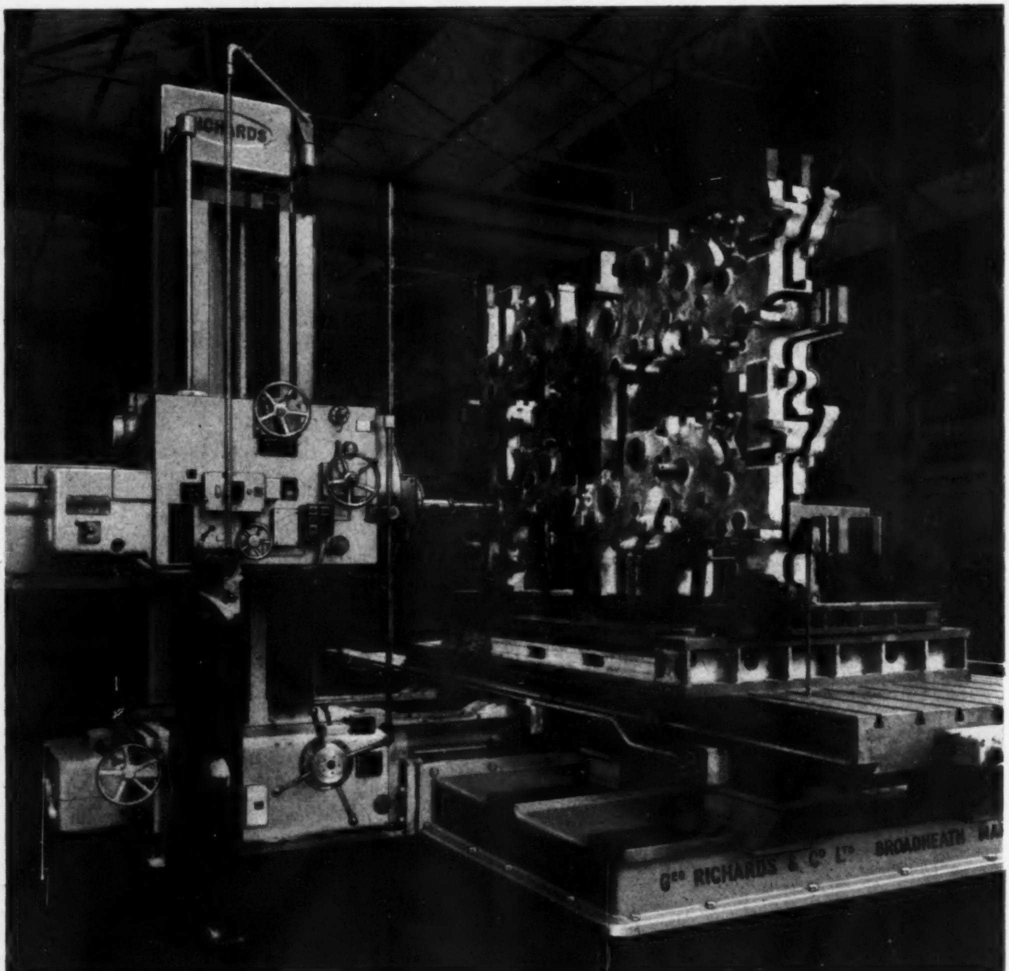

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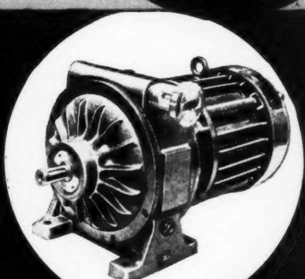

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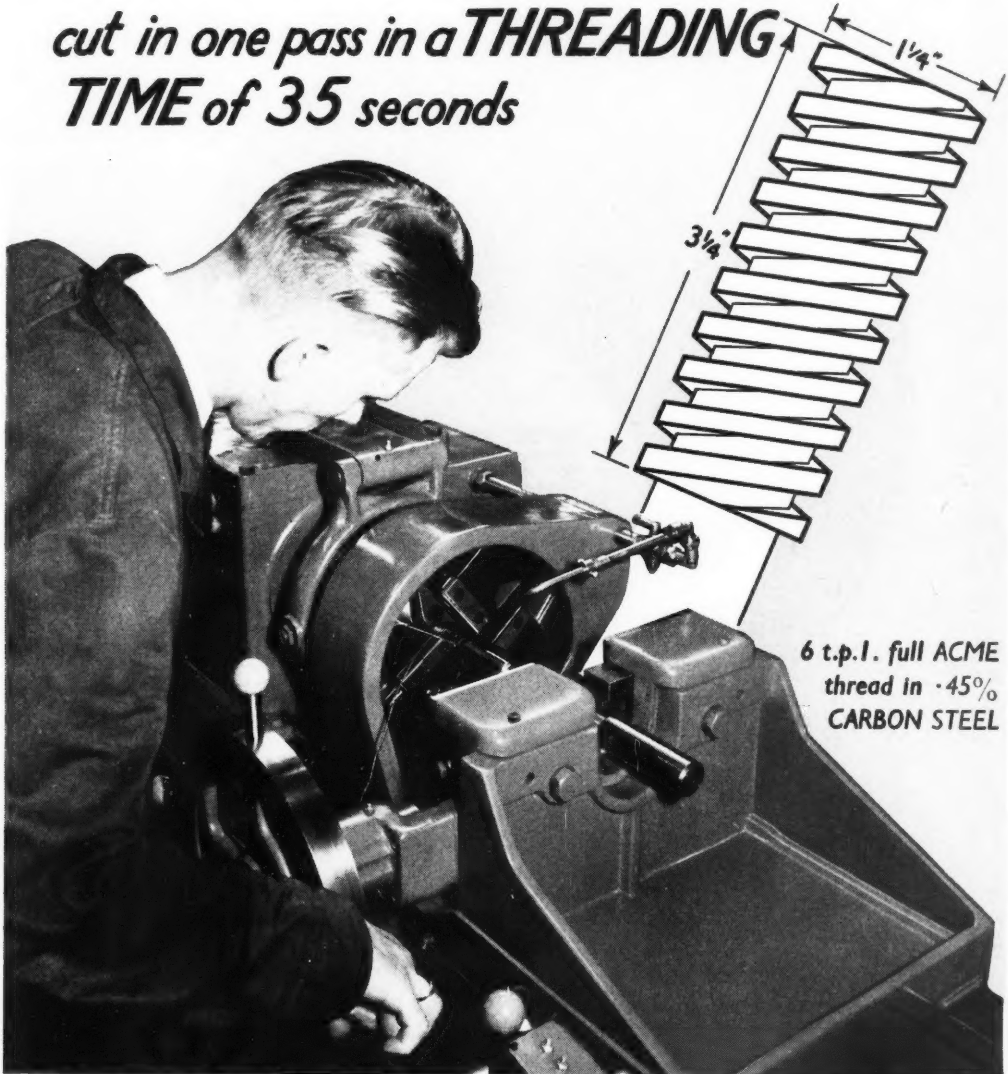

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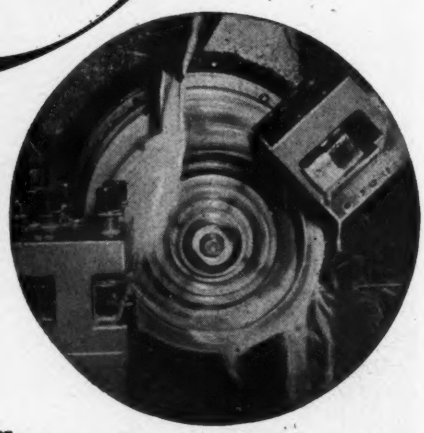

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MACHINERY

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Short Articles

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IN FORTHCOMING ISSUES

A Brazilian machine tool plant—Producing nuclear engineering components from graphite.

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

Overseas Trade

Considerable concern has been expressed regarding the latest trend in the overseas trade of the country as reflected in the relationship between the values of imports and of exports of United Kingdom products and manufactures. For the months of October and November—the last for which figures are available—imports totalled £798 million and exports £599 million. The discrepancy was thus £199 million or almost £100 million per month, and whereas trading during the period was to some extent affected by special circumstances, it is obvious that urgent steps must be taken to restore a more favourable relationship between exports and imports.

In 1955 imports averaged £324 million per month and for 1959 the average was £333 million. As between these two years, therefore, the rise in value was less than 3 per cent. It will be appreciated, of course, that these figures are not directly related because of changes in prices. Nevertheless, values form a convenient basis for comparing the trend of imports with that of exports. For the first 11 months of 1960, there was a sharp rise in the average figure for imports to £380 million, representing increases of 17 per cent and 14 per cent as compared with the years 1955 and 1959 respectively.

Exports in 1955 averaged £242 million per month, and by 1959 the figure had risen to £277 million, an increase of 14 per cent. There was thus a substantial improvement both in export value and in the ratio of export to import values. During the first 11 months of 1960, the average value of exports was £294 million, and whereas this figure was 21 per cent higher than the average for 1955, the improvement as compared with 1959 was 5·8 per cent. In other words, much of the ground that had been gained between 1955 and 1959, as regards the ratio of exports to imports, was lost during 1960.

When the first 11 months of 1960 are compared with the corresponding period of 1959, it is found that the aggregate growth of imports was £556 million. The principal individual increases which contributed to this sum were in non-ferrous base metals (£71·6 million), iron and steel (£59·4 million), metalliferous ores and metal scrap (£42·5 million), wood and cork (£39·7 million), road vehicles and aircraft (£39·6 million), chemicals (£37·3 million), and "machinery other than electric" (£33·8 million).

The rise in the value of exports as between the first 11 months of 1959 and 1960 was £200 million, and of this total, "machinery other than electric" accounted for no less than £77·8 million, iron and steel for £26·5 million, chemicals for £23 million, and road vehicles and aircraft for £19·2 million. On the other hand, there was a fall of £13·2 million in railway vehicles, and of £11·4 million in non-ferrous base metals.

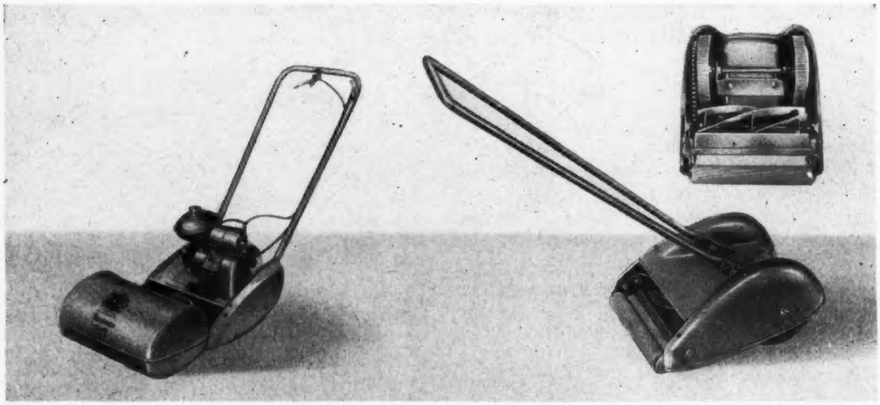
The growing importance of the contribution which metals and the principal products of the metal working industries make to our export trade will be evident from the following figures. These products are classified under the headings: iron and steel; non-ferrous base metals; manufactures of metals; machinery other than electric; electric machinery apparatus and appliances; railway vehicles; road vehicles and aircraft; and ships and boats. For these eight groups, exports in 1955 aggregated £1,480 million and thus accounted for slightly more than 50 per cent of all exports. In the first 11 months of 1960, the value of exports under the eight headings was £1,829 million, which was no less than 56·5 per cent of all exports.

Of the groups enumerated, easily the most important are those covering "machinery other than electric" and road vehicles and aircraft. In 1955, these two alone contributed £797·4 million or 27 per cent to the export total, and for the first 11 months of 1960 the corresponding figures were £1,114·7 million and 34 per cent.

In the light of these figures it seems evident that for further expansion of our export trade we must rely to an increasing extent on the efforts of those companies concerned with the production of various types of machinery and road vehicles of all kinds. It should be noted that the export classification "machinery other than electric" covers a very wide range and among the principal items, in the first 11 months of 1960, were agricultural and track laying tractors (£79 million); complete aircraft engines and parts (£67·2 million); textile machinery (£46·8 million); internal combustion engines other than for motor vehicles, tractors and aircraft (£32 million); excavating and earth moving machinery and road rollers (£27·4 million); machine tools (£26·7 million); and office machinery (£25·4 million).

Exports of machinery are very widely distributed, and in view of the criticisms that have

(*Continued on page* 106)



Producing Components for Domestic Lawn Mowers

Some Examples of Methods Employed at the Ipswich Works of Ransomes Sims & Jefferies, Ltd., for the Manufacture of Components for the Conquest and Sprite Machines

By A. W. ASTROP, Associate Editor

THE FIRST DOMESTIC LAWN MOWERS to be produced by the company which is now known as Ransomes Sims & Jefferies, Ltd., were built in 1832 under licence from Edwin Budding, who had developed the design from a type of cylindrical roller cutter employed in textile manufacture for trimming the nap of cloth. The machine was known as Budding's lawn mower, and it is interesting to note that the basic principle, namely a rotating cutting cylinder with helical blades and a fixed knife, has survived virtually unchanged to this day.

At the time when the first lawn mower was built, the company had already been in existence for 43 years, having been founded in 1789 by Robert Ransome, who set up in business as an iron founder, with one assistant. Today, there are some 3,100 employees, of whom approximately 510 are concerned with the production of lawn mowers, and the firm has large works at Ipswich and at Nacton, about three miles from the town centre.

Very early in its history, the company established a reputation for agricultural equipment, stemming from the development, in 1803, of a chilling method for producing cast iron plough shares. Ploughs still account for a substantial proportion of the output, and some of the advanced techniques and equipment employed at the Plough Works, Nacton, were described in MACHINERY, 89/996 — 2/11/56, 89/1332 — 14/12/56, and 89/1406 — 21/12/56. It will be appreciated that the demand for agricultural equipment of all types is influenced by seasonal requirements. Moreover, the demand is very sensitive to "good" or "bad" seasons, in terms of weather.

For these reasons, the company has long pursued a policy of progressive diversification of activities, one of the aims of which has been continuity of employment, regardless of the fluctuations in demand. In consequence, the company's products include: ploughs and agricultural implements; combine harvesters; cereal processing equipment; crop driers; hand, motor, and electric lawn mowers; gang mowers; small tractors; petrol and diesel engines; machine tools; electric motors and control gear; industrial and fork-lift trucks and tugs; and a wide range of forgings, castings, pressings, and sheet steel fabricated parts.

For many years, the company's activities in

connection with lawn mowers were directed to the production of high-quality specialist types, for example, machines suitable for maintaining bowling greens, cricket pitches, and golf courses, and a high reputation was established. Entry into the field of purely domestic machines was made at a comparatively late date, and was accompanied by the application of high-quantity production techniques, notably in connection with the Sprite and Conquest machines, which were introduced in 1959.

These machines are of interest from the standpoint of design, in that extensive use is made of medium- and heavy-gauge steel pressings in place of the traditional iron castings from which lawn mowers are usually constructed. Shown at the right and left, respectively, in the heading illustration, the Conquest and Sprite machines incorporate castings only for the bottom blade block, the land wheels and rear roller. All other components, apart from some bearings, are of steel, either machined or pressed, and extensive use is made of spot- and seam-welding techniques. A feature of the Conquest machine, which is of the side-wheel type, is that the cutting cylinder is wider than the land wheels, drive being transmitted by means of a roller chain. With this arrangement, which can be clearly seen in the under-side view, at the top right in the heading illustration, grass can be cut to the extreme edges, a facility which is normally associated only with roller-type machines.

It will also be noted that the Conquest machine has the land-wheels in advance of the cutting cylinder, the cut grass being discharged to the rear, where it is collected in a canvas container. The Sprite machine is conventional in design, as regards the disposition of the land-roll and cutting cylinder, and is powered by a 34-cc. JAP 2-stroke engine. Drive is taken from a V-belt to an intermediate shaft, thence by roller chain to the cutting cylinder, and by pinion to the land roll. It has a 14-in. cut, and the Conquest is made in 12- and 14-in. versions.

DEEP-DRAWN COVER FOR THE CONQUEST

One of the features of the Conquest machine is the streamlined cover which encloses the major portions of the cutting cylinder and land-wheels. This cover also serves as the main structural member, to which the two major assemblies—incorporating the land-wheels and associated spindle, and the cutting cylinder—are bolted. Close-up views of the top and underside of this component are shown in Fig. 1, and it will be seen that it is a one-piece pressing, with two deep portions to house the land-wheels. It is the depth of these "spats" that provides the necessary strength for the part, which is extremely rigid and is markedly resistant to deflection and twisting forces.

This cover is brought virtually to the finished condition in one blow on a Taylor & Challen 250-ton crank press, and for this operation the die shown in Fig. 2 is employed, in conjunction with a cast iron punch. Made from extra-deep-drawing 20-gauge steel (in the stabilized or fully-killed condition) this part is 6 in. deep from the bottom edge to the inside of the spats at the highest point. The die shown in Fig. 2 is of epoxy-resin construction and incorporates a cast-iron frame and top plate, with a number of steel inserts located in those areas where the drawing action is of particular severity.

The inserts at the centre of the die incorporate end-milled cavities which serve to form the depressions seen in Fig. 1. Of these depressions, the group of three at the centre serve as strengthening ribs for the flat portion, whereas those at either

Fig. 1. Two views of the deep-drawn pressing which serves as a cover and forms the main structural member of the Conquest lawn-mower

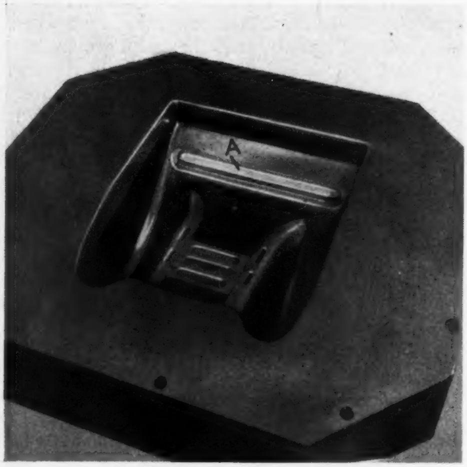


Fig. 2. This epoxy-resin die, which is provided with steel inserts, is employed to produce the pressing seen in Fig. 1

side provide locations for the brackets whereby the handle is secured.

When the deep-drawn cover pressing is removed from the die shown in Fig. 2 there is a transverse depression, formed by the insert *A*, and part of this depression is retained to provide the bead *B*, Fig. 1, when a large rectangular portion is blanked from the rear of the cover at a later operation. This portion is removed in order to provide an outlet for the grass that has been cut.

The trimming operation, also the piercing of various holes and apertures seen in the finished cover in Fig. 1, are performed on a Wilkins & Mitchell 300-ton press on which three sets of tools are provided. Despite the severe deep-drawing action involved in making these covers, it is stated that owing to careful tool design, and the use of high-quality sheet steel, the scrap rate rarely exceeds 3 per cent.

PRESSED-STEEL BODY FOR THE SPRITE

In Fig. 3 are shown top and under-side views of the pressed-steel welded body portion for a Sprite motor mower. This component is the main structural member for the machine and serves to house and support the land roll, the cutting cylinder, and bottom blade, also the 34-cc. engine. It is built-up from five separate pieces, three of which are seen in Fig. 4, namely, the centre section *C* and two intermediate side pressings *D*, which are of right- and left-hand design. These three pieces are subsequently welded together to form the sub-assembly *E*, and the side shields are added at a later stage.

The centre section *C* is produced by conventional tooling, from sheet material, but an interesting method is employed for the intermediate portions *D*. These parts are produced, two at a time, from a plain rectangular blank. The blanks are formed in two drawing operations, and prior to the second draw a nominally oval-shaped aperture is punched in the centre. At the second drawing operation, the depressions surrounding the pierced holes are formed.

Finally, the pressing is divided into two by a simple cropping operation, which removes narrow bands of metal at the points *F*. The centre section *C* is made from 20-gauge, and the intermediate portions *D* from 16-gauge steel.

Special equipment has been provided to facilitate spot welding the parts *C* and *D* together, to produce the sub-assembly *E*, and a close-up view

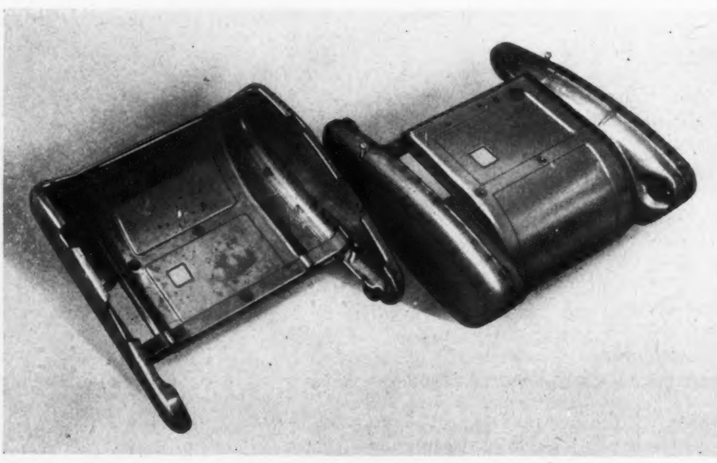


Fig. 3. Top and under-side views of the body portion for the Sprite motor mower. This part is fabricated from five separate pieces

of the installation is shown in Fig. 5. Basically, it comprises two horizontally-mounted double-acting air cylinders arranged on either side of a fixture which is designed to fit and support the under-side of the centre section *C*, Fig. 4. This fixture incorporates a plain peg *G*, which projects through one of the holes in the centre section and serves as a location, and a smaller peg *H*, with a transverse hole. The peg *H* also projects through one of the holes in the centre section, and a brass rod is passed through the drilled hole, to retain the lower edge of the workpiece.

Before the centre section is loaded into the fixture, the rams of the air cylinders are retracted, to leave space for the side members to be inserted, and engaged with the edges of the centre section. When the lever valve in the right background is operated, the rams of the cylinders are advanced simultaneously, to squeeze the three pieces together and to hold them rigidly during spot welding. This operation is carried out with a Sciaky hand-held prod-welding gun, and four spots are made at each side. The spot-welding is only an intermediate stage, and serves to hold the three parts together during a susbequent seam-welding operation, which is also carried out on a Sciaky machine. This operation has been completed on the assembly seen at *E*, in Fig. 4, which is ready for the side shields to be attached.

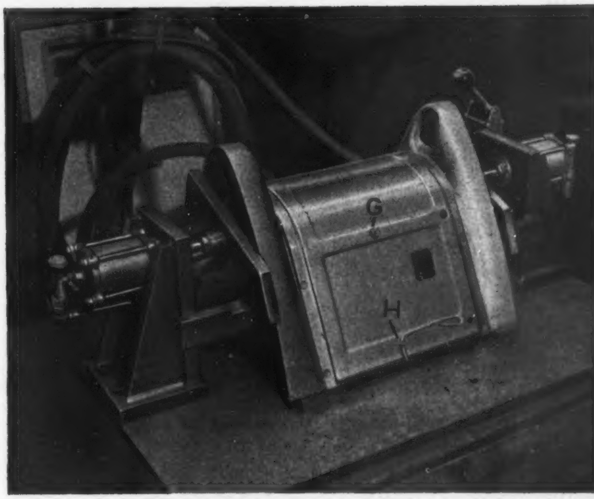


Fig. 5. This pneumatically-operated fixture is employed to facilitate spot-welding the centre section sub-assembly

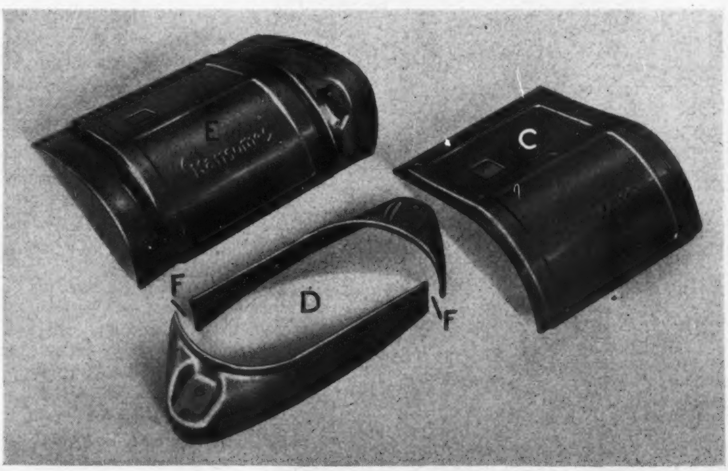


Fig. 4. The centre section sub-assembly for the Sprite body is shown at *E*, and is built up from the three pieces in the foreground

PRODUCING SIDE SHIELDS FOR THE SPRITE

Side shields for the Sprite machine are shown in Fig. 6, with a blank in the foreground. Made from 12-gauge deep-drawing mild steel, these items are of left- and right-hand design and are produced with an interesting multiple tool set-up on a 450-ton Wilkins & Mitchell press. A close-up view of the platen of this machine, with the tools in position, is shown in Fig. 7. There are six separate tools, arranged symmetrically on either side of the centre line, three for right-hand and three for left-hand workpieces.

Four operators tend this machine, two of whom stand at the far

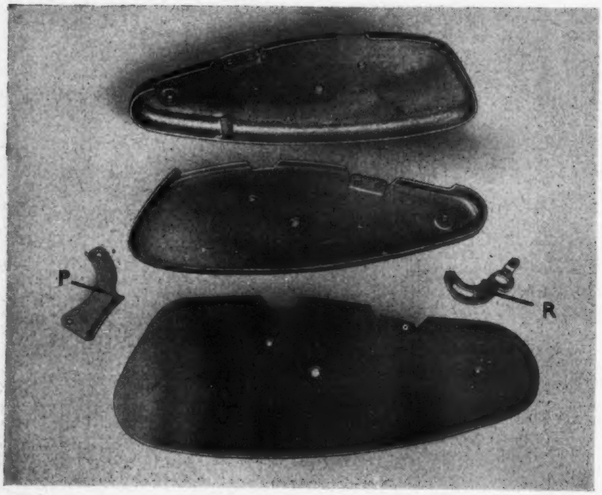


Fig. 6. Right and left-hand side shields for the Sprite body, and one of the 10-gauge steel blanks from which they are drawn. The two smaller components are made from the scrap remaining after the blanks have been produced

side (as viewed in Fig. 7) and are responsible for loading the pre-cut blanks on to the drawing tools, as at *J*. These tools form the parts to the shape seen at *K*, and as the ram rises, the pressings are removed from the drawing tools by hand and advanced through the press, where they are picked up by two more operators at the opposite side (in the foreground as viewed in Fig. 7). The part indicated at *K* is located in an angular fixture, to enable a small re-striking operation to be carried out by the tool *L*, and the part at *M* rests in a flat fixture while holes are pierced by the punches *N*.

With this set-up, a balanced flow of right- and left-hand parts is maintained, at a high rate, the press ram being controlled by the operator on the left at the far side of the machine. A simple edge-trimming operation is next carried out on the side shields and they are then ready for welding to the sub-assembly *E*, Fig. 4.

Referring again to Fig. 6, it will be noted that there are two small pierced and formed pressings adjacent to the side shield blank, as indicated at *P* and *R*. The part *P* is a bracket for the petrol tank, and the part *R* is one of a pair of arms which support the wooden roller. Both these items are formed from the scrap remaining after the blank in the foreground has been cut from the stock.

To facilitate the assembly of the body portion for the Sprite, the company has designed and built a special air-operated fixture, and a general view of this equipment is given in Fig. 8. The fixture is so arranged that it can be raised and lowered by means of the air cylinder seen in the centre foreground, to facilitate positioning the workpiece at a convenient height for some of the spot-welding operations.

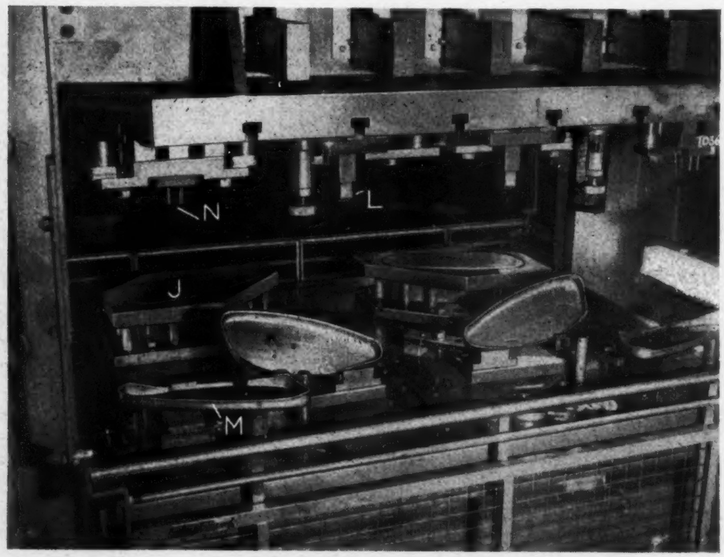


Fig. 7. Multiple tool set-up on a Wilkins & Mitchell press for drawing, piercing, and coining the side shields seen in Fig. 6. Right- and left-hand forms are produced simultaneously

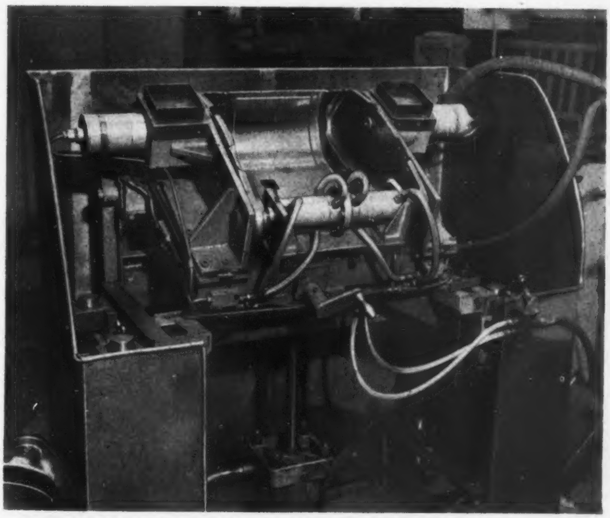


Fig. 8. General view of the special spot-welding fixture designed and built by the company for assembling the body portion of the Sprite mower

A close-up view of the fixture portion, unloaded, is shown in Fig. 9, where the copper back-up bars against which the spot-welded joints are made are indicated at *P*. These bars are carried on fabricated steel side members which are secured rigidly to the fixture and incorporate short-stroke, double-acting air cylinders, one of which is indicated at *R*. Also secured to the fixture, at the front, is a pair of similar double-acting air cylinders, mounted back to back, as shown at S. These cylinders are arranged to pivot, as a complete unit, about a horizontal axis, and can be swung outwards and downwards, to facilitate loading the work.

Projecting from the centre portion of the fixture, there are four taper-nosed, threaded plugs, as indicated at *T*, and these plugs are arranged to rotate but are restrained from moving axially. Attached to the under-side of each plug there is a plain spur gear, and portions of two of these gears can be seen protruding from the fixture at the left. All four gears mesh with a larger gear, which is mounted beneath the fixture and arranged to rotate on the centre *U*. This gear can be driven by turning the crank handle *V*, and as a result the four studs *T* are rotated, simultaneously. To load the fixture, a sub-assembly, as at *E* in Fig. 4, is inverted and placed upside down in the seatings provided, as shown in Fig. 10, which is a close-up view with the fixture fully-loaded in readiness for spot-welding.

The side shields, seen in Fig. 6, are in position, and attention is drawn to the steel strap *W*, which incorporates two weld-nuts. This strap is placed in the position shown, after the centre-section sub-assembly and side shields have been loaded. The four plugs *T*, Fig. 9, enter the weld-nuts on the centre section, and those on the strap *W*, and when the crank handle is turned they engage the threads, and simultaneously locate the work and pull it down on to the seatings provided. With this arrangement, the centre-section sub-assembly is rigidly secured in the required position.

During the loading cycle, air is admitted to the head ends of the rear cylinders and the rod ends

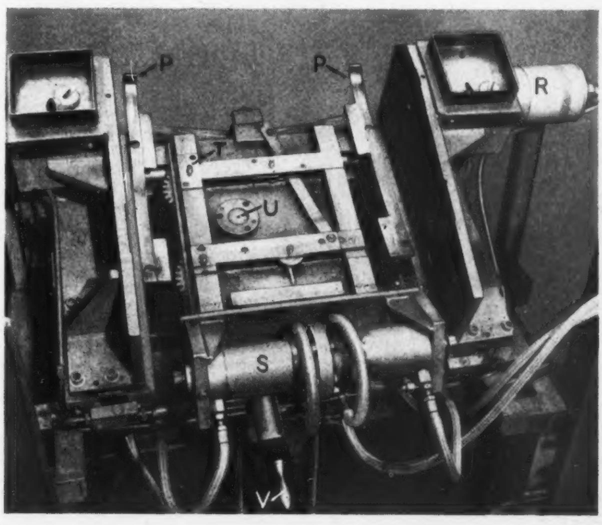


Fig. 9. Close-up view of the body spot-welding fixture showing the locations, and the air cylinders provided for clamping the side shields in position

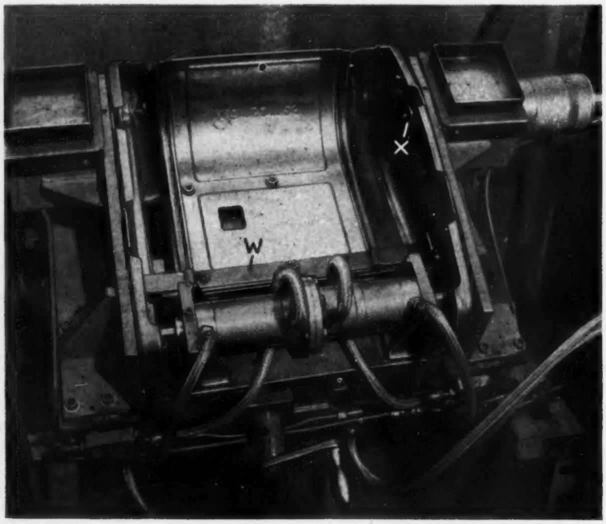


Fig. 10. The centre section sub-assembly and the side shields are here seen in position and clamped, in readiness for spot-welding

of the front cylinders, with the result that the rods of the former are extended, and those of the latter are retracted. Next, a plug with a large-diameter head is introduced from the inside of each side shield, so that the reduced-diameter portion of each passes through a hole in the shield and enters a bore (in the side wall of the fixture) which is coaxial with the front cylinders. The free ends of the rods of the rear cylinders are slotted, and a C-washer is slipped over each, as seen at *X* in Fig. 10. Operation of the lever valve seen at the right in Fig. 8 admits air simultaneously to all four cylinders, to retract the rams of the rear pair, and extend those of the front pair. As a result, the side shields are rigidly clamped to the side walls of the fixture, and the work is ready for spot-welding.

SCIAKY PROD-TYPE WELDING EQUIPMENT

This operation is carried out with a Sciaky hand-held prod-type gun, and joints are made at regular intervals to secure the side shields to the centre section. In addition, the strap *W* is spot-welded to the centre section, and despite the difference in thickness between the two components, satisfactory joins are consistently obtained. The first group of spot welds is made with the fixture in the highest position, and it is lowered, when required, by operation of a pedal valve. To unload the finished assembly, the supply of air to the cylinders is reversed, and the C-washers and headed plugs are removed and placed in the small sheet steel trays seen at the top left and right in Fig. 9.

Finally, the crank handle is turned in the reverse direction, to disengage the threaded plugs, and this action also serves to raise the workpiece from its seatings, ready for removal. Subsequently, the assemblies are passed to a Metro-Vick machine on which the joints are finish spot-welded.

Fig. 11. The two deep-drawn portions of the grass box for the Sprite are seam-welded together at this set-up

OTHER DEEP-DRAWN COMPONENTS

Two other components for the Sprite machine are also produced by deep drawing, namely the grass-box and the petrol tank for the J.A.P.

engine. An indication of the proportions of the grass-box is afforded by the close-up view Fig. 11, where a box is seen set-up in readiness for seam-welding on a Sciaky machine. Prior to this operation, the two portions, which are of 24-gauge deep-drawing steel, are spot-welded together in a simple box-type fixture which provides a seating for the deeper portion and a recess in which the flange is located. The shallower portion is merely placed in position on top, so that its flange also enters the recess, and eight fairly widely-spaced welds are made with a Sciaky hand-type prod-gun. It may be noted that a rectangular piece which is blanked from the larger portion of the box, to provide an entry for the grass cuttings, is subsequently used to make the concave deflector whereby the latter are directed from the cutting cylinder.

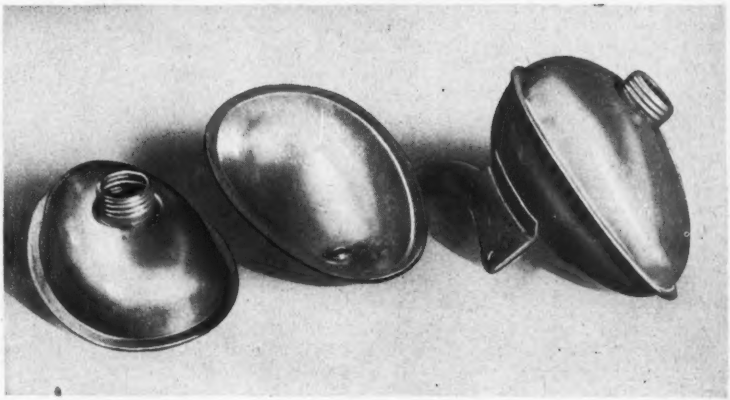


Fig. 12. (above) The two halves of the petrol tank for the Sprite, and an assembled tank

Fig. 13. (left) The engine bracket for the Sprite, seen at the rear, is produced from the blank in the foreground, and the two front roller arms at the left and right are made from the scrap material

A view of the two halves of the petrol tank for the Sprite is given in Fig. 12, where a fully-assembled tank, complete with its attachment bracket, may also be seen, at the right. The two deep-drawn pressings are first spot-welded together, in a simple

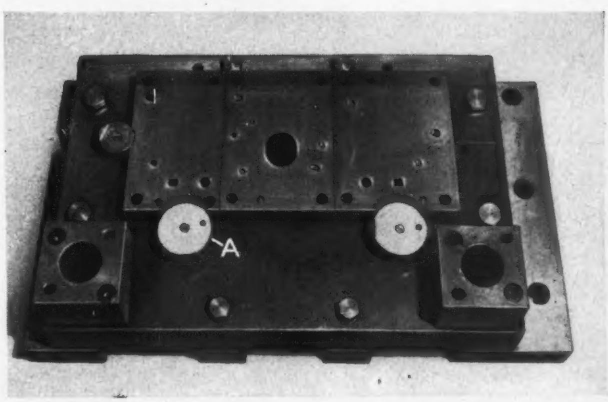


Fig. 14. First stage press tool for the engine bracket seen in Fig. 13

box-type fixture, and are then seam welded, to provide a fluid-tight joint. The filler tube and outlet port are assembled by induction brazing. This process is widely used in the production of the Sprite and Conquest machines, and further reference will be made to it in another article which is to be published shortly in MACHINERY.

The engine bracket for the Sprite machine is made from 10-gauge mild steel and is of fairly complex shape and design. One side of this bracket may be seen in the heading illustration, and a close-up view of the complete part—in a very similar angular position—is shown in Fig. 13. It will be seen that the part incorporates a number of severe bends, and these are performed after a rectangular blank has been brought to the shape seen in the foreground. It may be noted that the two small arms, also seen in Fig. 13, are made from the scrap remaining after the engine bracket has been blanked to shape.

At the first operation on the pre-cut rectangular blank a number of holes is pierced—including the group of three required in each of the small curved arms—and the die portion of the tool is shown in Fig. 14. In this tool, the blank is located from one long edge by the buttons *A*, and at the left-hand end by a similar arrangement. It will be noted that provision is made for finishing, or starting, a number of the holes in the engine bracket, including the large oval aperture through which the output shaft of the motor projects.

The second stage tool, seen in Fig. 15, finishes the piercing operations on the engine bracket, and blanks out the two curved arms complete. These items are subsequently bent, two at a time, in another tool, which is arranged to produce left- and right-hand forms simultaneously. Next, the periphery of the part is cropped to the shape seen in the foreground in Fig. 13, and the blanks are loaded into a first-stage bending tool. Here, the four flanges are formed, namely, the two feet whereby the bracket is attached to the centre section of the body assembly, and the long and short flanges which project from the upright portions and provide for the attachment of the belt cover.

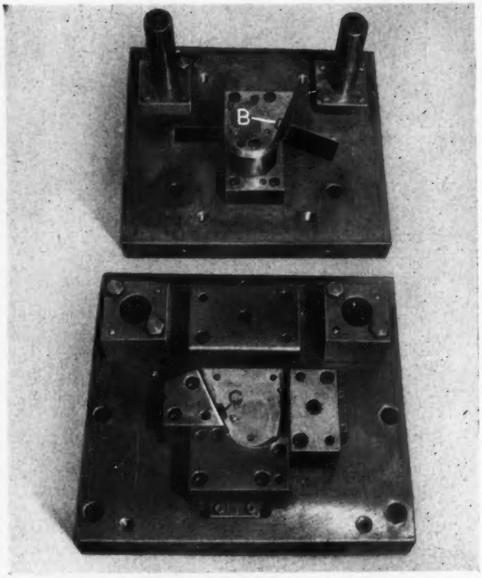


Fig. 16. The final bending tool for the engine bracket also provides for coining the small flange which serves as one attachment point for the belt guard. Pilot pins locate the part by holes pierced at a previous stage

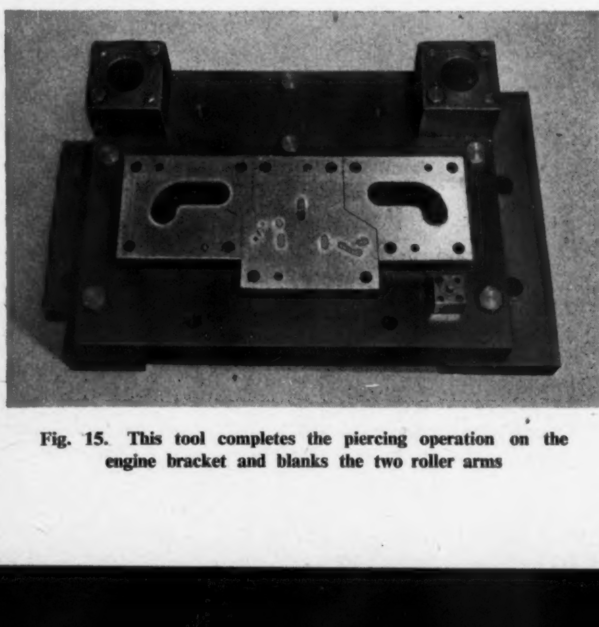


Fig. 15. This tool completes the piercing operation on the engine bracket and blanks the two roller arms

FINAL BENDING AND COINING TOOL

In Fig. 16 is shown the final bending tool which serves to bend the side portions round at 90 deg. Attention is drawn to the two pilot pins in the die half, which enter previously pierced holes in the front face of the bracket—as viewed in Fig. 13—for location purposes. The punch incorporates a small projection *B* which coincides with the aperture *C* in the die

portion of the tool. This aperture accommodates the smaller of the two flanges on the upright portion of the bracket, and at the end of the stroke the projection *B* performs a coining operation on this flange. In this way, the flange is finally straightened up, to ensure that it projects accurately at right-angles to the front of the bracket.

In further articles, some of the equipment installed for high-quantity induction brazing will be considered, also various aspects of machining practice, cutting cylinder and blade production, and flow-line assembly procedures.

Set-up for Broaching on a Planing Machine

By F. KELLNER

THE MACHINE SHOP OF WHICH the writer is foreman received instructions to make a batch of extrusion dies to produce a part with a triangular cross section. No broaching machine was available and it was arranged to carry out the operation on an open-side planer. The broach was made by one of the shop toolmakers.

Fig. 2. The triangular aperture broached in this extrusion die has equal sides and identical radii in the three corners

As seen in Fig. 2, the die aperture is required to have three identical straight sides and identical corner radii. The blanks were turned and faced on a turret lathe, and a centre hole was drilled through each. Next, the blanks were scribed on the top face with the required triangular layout. A vertical bandsaw was then used to cut to about 0·015 in. inside each of the lines.

The broaching tool was 24 in. long, with 38 cutting teeth, and was made from tool steel and hardened. The set-up on the planer is shown in Fig. 1. After the tool-slide had been removed, a back-up plate was bolted to the saddle to support the blank during broaching. Two blocks were secured to the planer table with their centres on a line parallel to the direction of motion.

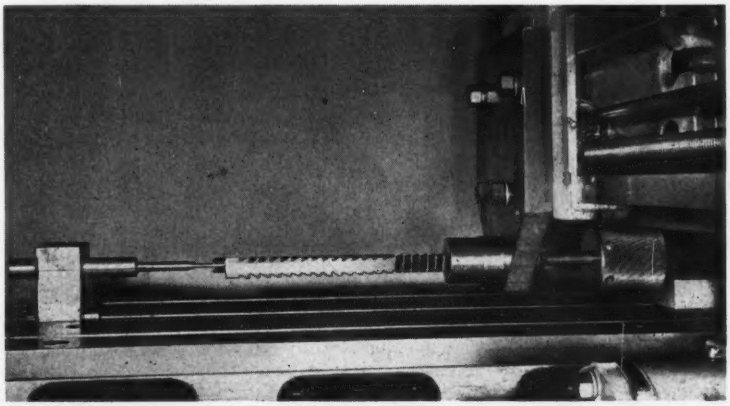


Fig. 1. A view showing the planer adapted for broaching the extrusion die, which is supported by a back-up plate on the saddle

One of these blocks, seen on the right, served as a gripping head to pull the broach through the aperture of the die with the latter supported by the back-up plate. The other block carries an adjustable centre, which serves to maintain the alignment of the broach. When the table was moved at slow speed to the right, the broach was drawn through the aperture. The resulting dies met the required dimensional tolerances, and the operation was performed without any particular difficulty.

The Cold-hobbing of Hot-working Steels*

By Dr. ING. W. HAUFE

TO ENABLE A VARIETY OF COMPONENTS to be manufactured more economically, methods of reducing tool costs are constantly being studied, and it will be evident that savings are particularly important in connection with tools required for hot working, for many of which the service life is necessarily comparatively short. The advantages of producing suitable tool cavities by cold-hobbing are now widely appreciated, especially where numbers of identical impressions are required, but hitherto the application of this process has been confined largely to the production of moulds for the plastics industry. With the introduction of high-performance hot-working steels which can be cold-hobbed, however, hot-working tools are being produced in this manner on an increasing scale. These steels, and their fields of application are here considered.

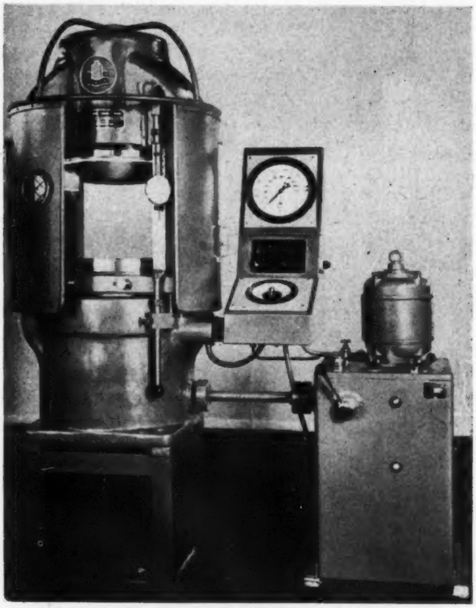


Fig. 2. Sack & Kiesselbach oil-hydraulic press of 630 tons capacity with provision for varying the hobbing speed

THE COLD HOBBING PROCESS AND ITS ADVANTAGES

For cold hobbing, a male tool corresponding to the impression required is produced on a copy milling machine. Such a hob can almost always be made more cheaply, more accurately, and with a better surface finish than a machined cavity. It follows, moreover, that when a series of cavities is produced with a single hob they are all identical, whereas small variations are inevitable if multiple impressions are machined with milling or engraving cutters. During the hobbing operation, the hardened hob is pressed slowly into an annealed steel blank, and the cavity is formed by displacement of the material. Provided that the surface of the blank presented to the hob is ground, the high finish on the tool is reproduced in the cavity, and this finish is subsequently imparted to the product. In addition, the life of a hobbed cavity is normally greater than that of a cavity produced by machining, because the grain formation of the metal which results from deformation is more favourable.

The economies achieved by hobbing are, of course, particularly marked where numerous identical cavities are required. Fig. 1 shows a time comparison for the production of header inserts for M24 hexagon bolt heads by hobbing and machining. Due to the difficulties of producing an accurate internal hexagon, the time required for

* This article, here slightly abridged, was first published in the journal "TZ for Practical Metalworking." 54th year, 1960, issue 5, pp. 221-227. Publishers-Gunter Grossman G.m.b.H., Stuttgart-Vailingen.

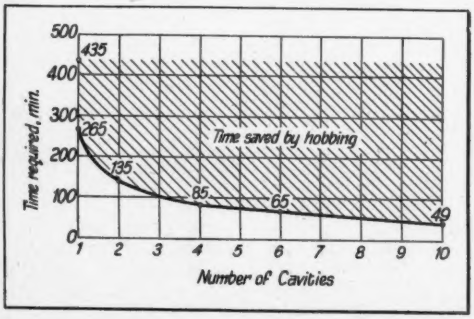


Fig. 1. Times required for producing various numbers of hot heading die inserts by cold hobbing. The shaded area represents time saved by hobbing as compared with machining

sinking each cavity by machining and hand work is 420 min. and the total time per insert, 435 min. On the other hand, a hob for this cavity was produced in 240 min., and the time for rough turning and subsequently hobbing each insert is 25 min. It will be noted, therefore, that the time saving for the first cavity is 170 min.

When more than one insert is required, the time per insert is progressively reduced, in accordance with the hyperbolic curve in Fig. 1. For ten tools, for example, the average time by the hobbing method is 49 min., and the saving on the 10th tool is nearly 90 per cent. In the figure, the shaded area represents the time saved by hobbing. As a rule, a hob made from 12 per cent chromium steel, and hardened to 43 Rockwell C will produce more than 40 cavities of this type.

For cold hobbing, oil-hydraulic presses, with provision for accurate setting and adjustment of the penetration rate, are most suitable. These presses are built in various sizes, and an example, built by Sack & Kiesselbach (Rockwell Machine Tool Co., Ltd.), is seen in Fig. 2.

A typical tooling arrangement is shown diagrammatically in Fig. 3. The die insert *A*, which is machined on all surfaces and ground on the top face, is held in the chase *B* which should be heat-treated to a tensile strength of 125 kg. per sq. mm. (80 tons per sq. in.). The support plate *C* for the insert and chase, and the backing plate *D* for the hob, are both hardened to an ultimate tensile strength of 200 kg. per sq. mm. (127 tons per sq. in.).

TABLE 1. COMPOSITIONS OF HOT-WORKING STEELS ON WHICH HOBBING WAS CARRIED OUT EXPERIMENTALLY

Steel	Ref. No.	Designation (Stahl und Eisen)	Composition, per cent. C.	Si.	Mn.	Cr.	Mo.	Ni.	V.	W.	Brinell No.
1	2713	55NiCrMoV 6	0·55	0·3	0·6	0·7	0·2	1·7	0·1	—	252
2	2581	30WCrV34 11	0·30	0·2	0·3	2·5	—	—	0·4	9·0	223
3	2603	45WCrVMo 58	0·45	0·6	0·4	1·5	0·5	—	0·8	0·5	220
4	2567	30WCrV17 9	0·30	0·2	0·3	2·5	—	—	0·6	4·5	215
5	2343	40CrMoV 21	0·40	1·0	0·4	5·5	0·9	—	0·5	—	212
6	2365	32CrMoV 33	0·30	0·2	0·4	3·0	2·75	—	0·5	—	187
7	—	—	0·07	0·25	0·3	5·0	—*	—	—	—	115

* May contain up to 0·5 per cent Mo.

RESULTS OBTAINED WHEN COLD HOBBING STEELS SUITABLE FOR HOT-WORKING TOOLS

Choice of die material is determined by the conditions under which the finished tool must perform in service. In no circumstances must tool life be reduced by the choice of a die material which facilitates hobbing but does not have adequate properties to withstand the service conditions. The

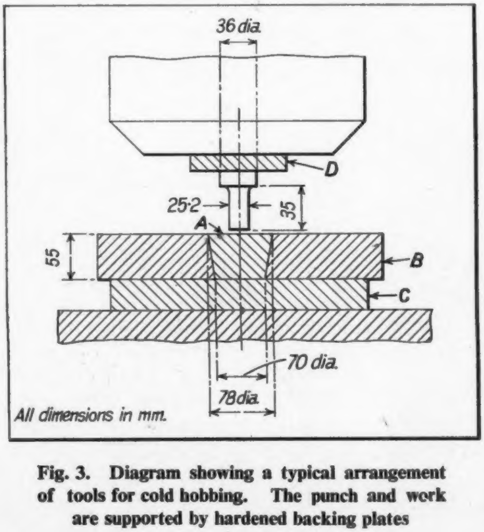


Fig. 3. Diagram showing a typical arrangement of tools for cold hobbing. The punch and work are supported by hardened backing plates

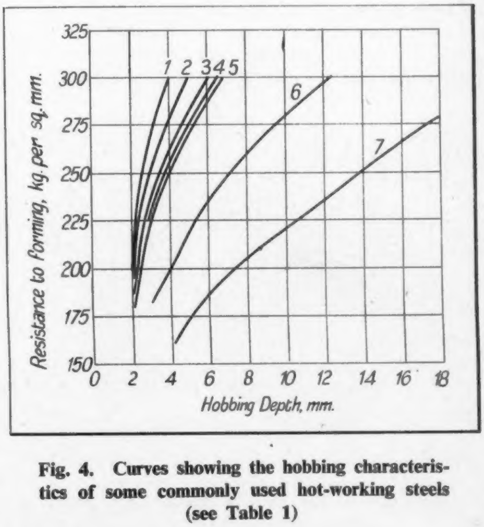


Fig. 4. Curves showing the hobbing characteristics of some commonly used hot-working steels (see Table 1)

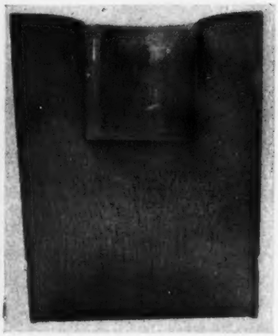


Fig. 5. Ground longitudinal section through a 1·18-in. square by 1·06 in. deep hobbed cavity in type 2365 molybdenum steel. The blank was specially annealed to reduce the tensile strength to 36 tons per sq. in.

extent to which some commonly used hot-working steels, as listed in Table 1, can be hobbed, is indicated in Fig. 4. From the graphs it will be noted that the chromium-nickel-molybdenum steel 2713 is particularly difficult to hob on account of the nickel content and high annealed strength. Similarly, the 10 per cent tungsten steel 2581 can only be hobbed with great difficulty. The chromium-tungsten-molybdenum steel 2603, the 4·5 per cent tungsten steel 2567, and the chromium-molybdenum-vanadium steel 2343 are not much easier to hob. Very much better results can, however, be obtained by use of the chromium-molybdenum steel 2365 which contains 2·75 per cent of molybdenum.

Under the conditions established for the experiments, molybdenum steel 2365 can be hobbed with a specific pressure of 300 kg. per sq. mm. (190 tons per sq. in.) to a depth of 12·5 mm. For the molybdenum steel 2343, however, the depth is only 7 mm., for the 4.5 per cent tungsten steel 2567, 6·5 mm., and for the 10 per cent tungsten steel 2581, 5 mm. The hobbing depths are thus in a ratio of 100 : 54 : 48 : 41. Maximum hobbing depth obtainable is determined mainly by the annealed strength of the steel. For the steels investigated, the hardness corresponds to the annealed strength. The molybdenum steel 2365, as employed for the experiments, had an annealed strength of 65 kg. per sq. mm. (41·5 tons per sq. in). By a special annealing process the annealed strength can, however, be reduced to 55 kg. per sq. mm (35 tons per sq. in.) and the hobbing possibilities for this steel are thus further improved. The exceptionally good hobbing properties of molybdenum steel 2365 after the special annealing treatment will be evident from Fig. 5, which shows a ground section through a 30-mm. square hobbed cavity, 27 mm. deep. The annealed strength of this specimen was 57 kg. per sq. mm. (36 tons per sq. in.).

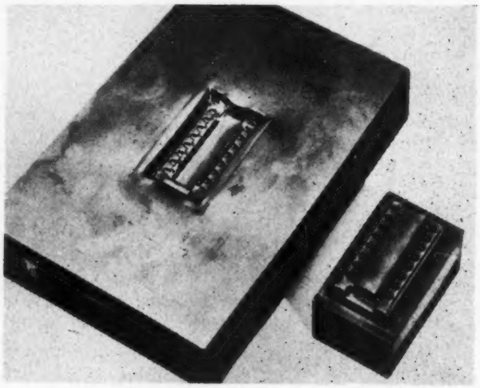


Fig. 7. A hob and a hobbed (but unmachined) insert of type 2365 molybdenum steel for a multi-cavity die for pressure casting safety razor parts in zinc-base alloy

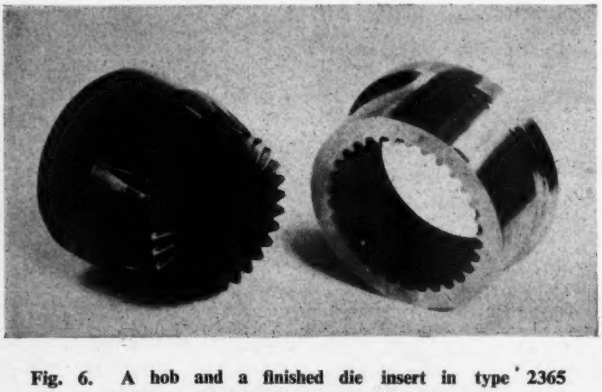


Fig. 6. A hob and a finished die insert in type 2365 molybdenum steel for pressure casting brass gears

Due to their higher thermal conductivity, molybdenum steels are generally to be preferred to tungsten steels. The thermal conductivity of the molybdenum steel 2365 is approximately 30 per cent higher than that of the comparable 10 per cent tungsten steel 2581. On tungsten steels, heat cracks form an open mesh pattern whereas with molybdenum steels the mesh is finer and the cracks do not generally appear until after a longer period of service. Experience has

shown that a fine mesh of cracks is less detrimental to hot-working tools, since such cracks are not as deep and do not lead so quickly to flaking away as do the coarse mesh cracks common with tungsten steels.

Performance reports on some pressure die casting dies clearly indicate that molybdenum-alloy hot working steels with high thermal conductivity are superior to comparable tungsten steels with lower thermal conductivity from the standpoint of heat cracking. The hardening temperature of the molybdenum steel 2365 is lower than that of the comparable 10 per cent tungsten steel 2581, and the risks associated with hardening are therefore reduced. Recommended heat treatments for 2365 steel are as follows: for stress relieving and for soft annealing it is heated to 550 deg. C. and 750-780 deg. C., respectively, and cooled in the muffle; the hardening temperature is 1,000 to 1,040 deg. C., and quenching may be carried out in warm oil or by air blast. Rockwell C hardness values of 53, 52, 50, and 45 are obtained when the steel is tempered at 20, 550, 600, and 650 deg. C., respectively.

On account of the properties discussed above, molybdenum steel 2365 is being increasingly adopted for light alloy and brass pressure die casting dies, for dies and punches used in hot nut and bolt manufacture, and for forging dies and forging die inserts.

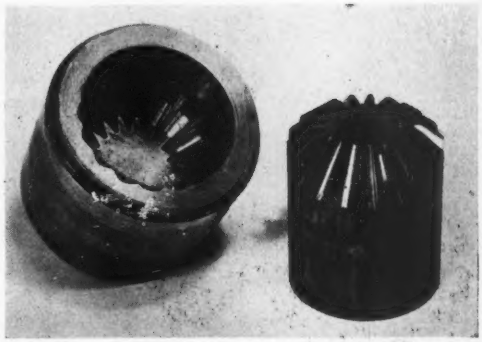


Fig. 9. A hob and a hobbed die insert of special chromium steel (No. 7 in Table 1)

Fig. 8. Hobs and hobbed (but unmachined) inserts in type 2365 molybdenum steel for dies for pressure casting aluminium gears

PRESSURE DIE CASTING DIES

Fig. 6 shows the hob and a completed insert for a brass pressure die. The relatively short life of dies used for casting brass under pressure greatly affects the economics of the process. By cold hobbing, however, it is possible to produce a large number of profiled inserts simply and cheaply from a single hob. Then, as soon as the first cracks appear and the parts are no longer acceptable, the inserts can be changed.

In Fig. 7 are seen a hob and a cold

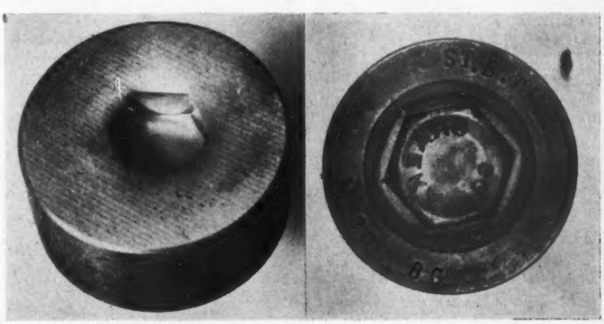


Fig. 10. Cold hobbed inserts of molybdenum 2365 steel for heading hexagon bolts. The insert on the right, with lettering in the impression, is shown in the condition in which it was removed from the machine

Fig. 11. (above) Hob and cold hobbed die insert for heading hook bolts

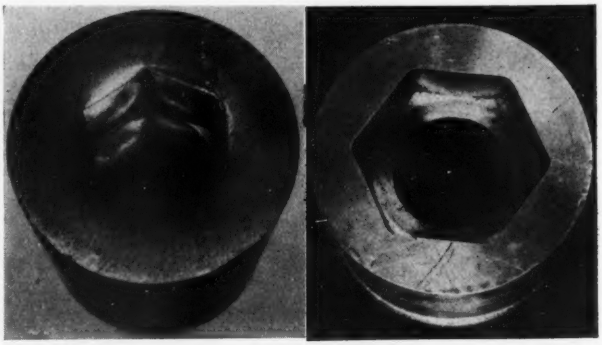


Fig. 12. (right) A cold hobbed and finished machined die insert for hot pressing a brass bolt head

hobbed—not yet machined—insert for a multiple pressure casting die for the production of safety razor components in zinc alloy. Hobs and cold hobbed (unmachined) die inserts for casting aluminium gears are shown in Fig. 8. Originally, these inserts were produced on gear cutting machines by an outside contractor. The introduction of cold hobbing resulted in considerable savings. In addition the user is now independent of outside assistance.

For dies for pressure casting zinc-base alloy, a special steel with extremely good hobbing properties is frequently employed. This steel, which is No. 7 in Table 1 and Fig. 4, has an ultimate tensile strength, when annealed, of only 40 kg. per sq. mm. (25 tons per sq. in.), as compared with approximately 56 kg. per sq. mm. (35·5 tons per sq. in.) for the molybdenum steel 2365. The hobbing characteristics of the two steels may be compared from Fig. 4. A hob and a cold hobbed insert of this special chromium steel are seen in Fig. 9. This insert, for a die for casting a bevel gear in zinc alloy, has been hobbed to a greater depth than necessary, to demonstrate the exceptional hobbing properties.

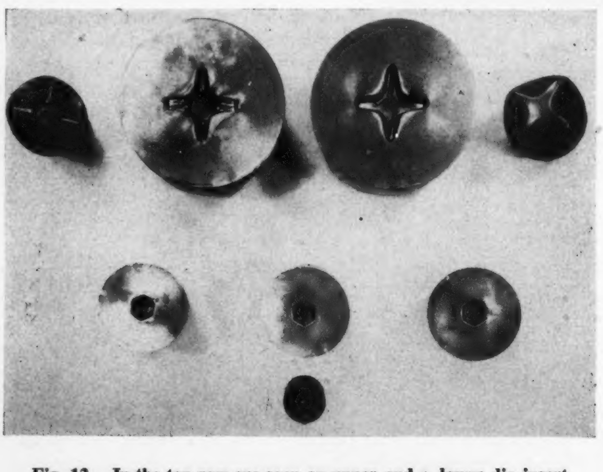


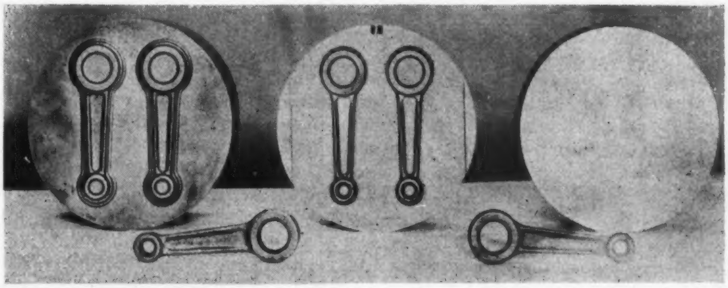
Fig. 13. In the top row are seen an upper and a lower die insert for stamping a brass star handle, with the hobs employed for producing the impressions. The lower row shows die inserts for hot pressing brass flange nuts

Apart from those for producing gear and other complicated forms, cavities in which letters or numerals are required on the bottom surface can often be produced with great economy by hobbing.

Cold hobbed dies made from the special (No. 7) chromium steel are carburized in a salt bath or other case-hardening medium and hardened in oil. After they have been tempered at 450 deg. C., the surface hardness is 52 Rockwell C, and the core strength 110 kg. per sq. mm. (70 tons per sq. in.). It is also possible to harden such dies by nitriding.

General instructions for the heat treatment of this steel are as follows. For stress relieving it is heated to

550 deg. C., and for soft annealing to 840 deg. C., and after either treatment is allowed to cool in the muffle. The carburizing temperature is 880 to 910 deg. C. (for salt-bath carburizing 900 to 910 deg. C.), and the hardening temperature 950 deg. C. Quenching may be carried out in



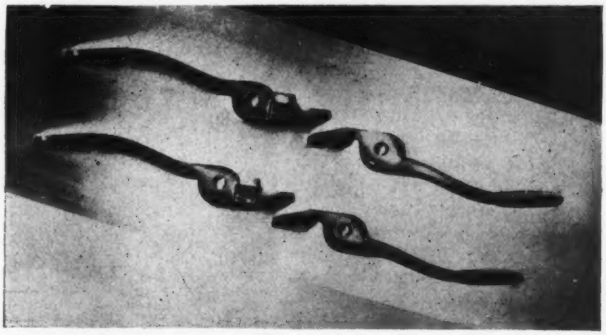


Fig. 14. (above) Hob and cold-hobbed insert for a die for forging small connecting-rods for internal combustion engines

Fig. 15. (left) Cold hobbed 4-impression coining die employed in the production of combination pliers

warm oil or in air. After tempering, the Rockwell C hardness value ranges from 64 (for 200 deg. C.) to 52 (for 500 deg. C.). The core hardness is 285 Brinell.

TOOLS FOR HOT STAMPING BOLT HEADS

In the nut and bolt industry, the cold hobbing process has been employed for some time for the production of dies for hot heading hexagonal bolts. Fig. 10 shows a cold-hobbed heading tool insert, of molybdenum steel 2365, for M 24 hexagonal bolt heads. Cavities with lettering are frequently hobbed as seen at the right. The hob and a cold hobbed die for heading hook bolts are seen in Fig. 11. To ensure the desired grain formation in the steel, at the highly stressed areas where the contour changes to a round bore, the cavity was pre-hobbed.

HOT BRASS STAMPING DIES

Molybdenum steel of type 2365 has also proved very satisfactory for hot brass stamping dies and enables some tools of this type to be produced by cold hobbing. Fig. 12 shows a cold hobbed and a finished machined die insert for the production of brass bolts with hexagonal heads. To reduce the hobbing pressure, the ejector hole was drilled prior to hobbing. In Fig. 13 are seen the upper and lower portions of a die for pressing brass star handles and the hobs are also shown.

FORGING AND COINING DIES

For the most part, chromium-nickel-molybdenum steels of types 2713 and 2714 are used for forging dies. These steels can only be hobbed to a small extent as is indicated in Fig. 4. More

TABLE 2. COMPOSITIONS OF COMMONLY-USED HOB STEELS

Ref. No.	Composition (Mean Values) per cent.						
	C.	Cr.	Ni.	Co.	Mo.	V.	W.
2080	2·0	12·0	—	—	—	—	—
2201	1·7	12·0	—	—	—	0·1	—
2601	1·7	11·5	—	—	0·6	0·1	0·5
2880	1·7	12·0	—	1·3	0·5	—	—
2721	0·5	1·4	3·3	—	0·2	—	—

TABLE 3. HEAT TREATMENTS FOR HOB STEELS LISTED IN TABLE 2

Ref. No.	Hardening temperature, deg. C.		Tempering temperature deg. C. for Rockwell C. hardness values of				
			64	62	60	58	56
2080	960–980	Quenched in oil at 450 deg. C.	150	250	300	400	500
2201	940–980		150	250	300	400	500
2601	940–1000		150	250	300	400	500
2880	960–1000		150	250	300	400	500
2721	820–840	Quenched in oil	—	—	100	160	200

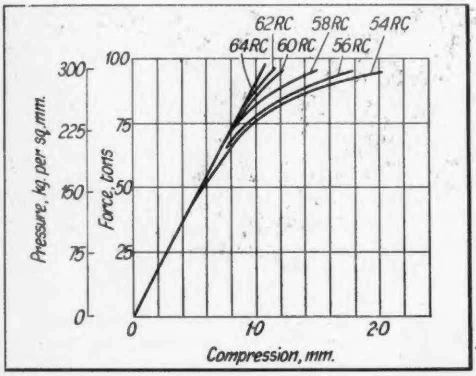


Fig. 16. Results of compression tests on 2080 chromium steel tempered to 64, 62, 60, 58 and 54 Rockwell C

recently, especially for coining dies, but also for forging dies in some instances, the high quality 2365 molybdenum steel is being increasingly applied, generally in the form of die inserts, and certain of these inserts can be made by the cold hobbing process.

In Fig. 14 are shown the hob, a cold hobbed die insert for the production of small internal combustion engine connecting rods, and a machined blank ready for hobbing. A 4-impression cold hobbed coining die for use in the manufacture of combination pliers is seen in Fig. 15.

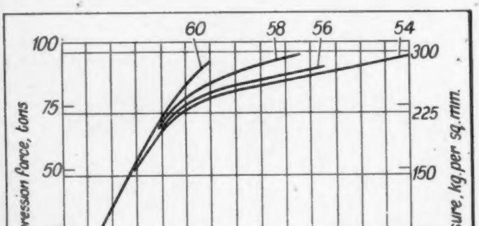


Fig. 17. Results of compression tests on 2721 chromium-nickel steel (C. 0·5, Ni. 3·3, and Mo. 0·2 per cent) tempered to 60, 58, 56 and 54 Rockwell C

HOB REQUIREMENTS

Hob life if of great importance if hobbing is to prove economical. The determining factors for hob life are the correct choice of steel for the hob, and correct design and hardening. The steels mainly used for hob production are listed in Table 2, and particulars of the heat treatments for these hob steels are given in Table 3.

For hobbing pressures up to 300 kg. per sq. mm. (190 tons per sq. in.), 12 per cent chromium steels have proved most satisfactory on account of their high compressive strengths. In addition to the type 2080 chromium steel with 2 per cent C. and 12 per cent Cr., other compositions have been employed, especially the following 12 per cent Cr. steels: 2201 with 1·7 per cent C.; 2601 with C. 1·7, Mo. 0·6, W. 0·5, and V. 0·1 per cent; and 2880 with C. 1·7; Mo. 0·5, and Co. 1·3 per cent. The use of steels containing Co. appears to be unnecessary, however, since the main effect of this alloying element is to increase the hot hardness, and this characteristic cannot be exploited in cold hobbing. Hobs should be hardened to Rockwell C 62-64 unless the shape is such as to make a lower value desirable. The effect of hardness on compression deflection is shown in Fig. 16 for the type 2080 12 per cent Cr. steel. Only when unusual toughness is required should the type 2721 Cr.-Ni. steel be selected in preference to the 12 per cent Cr. steels. For type 2721 steel, the maximum Rockwell C hardness obtainable is 60, and for this reason hobs made from this steel can only be loaded up to 250 kg. per sq. mm. (160 tons per sq. in.), as indicated in Fig. 17.

Fig. 18. Correctly designed hob of 2080 chromium steel for producing cavities for M24 bolt heads

Sharp changes of contour must be avoided when designing a hob. An evenly flowing contour with radii at the corners is desirable and such a form will also facilitate hardening. If there are sudden changes of section, stress concentrations will be set up which may cause overloading and failure of the hob. A correctly designed hob is shown in Fig. 18. The head of the hob should

Fig. 19. This incorrectly designed hob of 2080 chromium steel fractured in service

be approximately 15 mm. larger in diameter than the hobbing portion to facilitate release of the tool after the operation has been completed. It is recommended that the hob should be shrunk into a support ring, as higher forces can then be withstood. Fig. 19 shows a hob with a satisfactory radius between the smaller portion and the head. Where the hexagonal faces met the smaller cylindrical diameter, however, the form was not blended as shown in Fig. 18. Similarly, the corners of the hexagon were left sharp. Due to the resulting stress concentrations the hob fractured.

Wax Type WB-2 and WB-3 Hydraulic Tube Bending Machines

In the illustration is shown the Wax type WB-2 hand-operated hydraulic tube bending machine marketed by Scot Urquhart, Ltd., 373a Earlsfield Road, London, S.W.18.

Weighing 176 lb., this machine has a capacity for cold bending unfilled tubes from ⅛ to 2 in. diameter, and a maximum force of 12 tons can be applied by the hydraulic pump, which requires no external oil supply. Formers in six different sizes are provided for bending of tubes of various diameters within the capacity of the machine, and other sizes can be supplied to suit requirements. The forming head and hydraulic unit can be swivelled in the horizontal plane on the tripod base to facilitate bending long tubes. Alternatively, the machine can be supplied with the forming head and hydraulic unit fixed to the base. Larger machines of similar design are available which have capacities for bending tubes up to 3 in. diameter. The range also includes a Wax Pracis machine, which is intended for bending thin-wall tubing up to 1 in. diameter, for the production of components for tubular furniture.

Wax type WB-2 hand-operated hydraulic tube bending machine

New Range of Burnand Phoenix Lifting Magnets

W. E. Burnand & Sons, Ltd., Duo Works, 66/106 Shoreham Street, Sheffield, 1, have recently introduced a new range of electro lifting magnets, which are at present offered as an alternative to the Composite units, but will eventually supersede the latter. Known as the Integral type, the range of magnets, of which an example is shown in the accompanying figure, are of new design and incorporate a single high-permeability steel casting which forms the body portion. Another feature of the Integral magnets is the use of a new type of insulation for the high-conductivity copper coil, which is claimed to give an improved performance as compared with the conventional cotton or asbestos materials employed hitherto.

An example from the new Integral range of Burnand electro lifting magnets

The one-piece design is stated to provide a more robust unit which is more economical to produce.

Lacromatic Vibrator for Deburring and Polishing Metal Parts

VARIOUS ADVANTAGES are claimed for the Lacromatic Vibrator shown in Fig. 1, which is intended for deburring and polishing small and medium-size metal parts of a wide range of shapes and materials. The unit is built, to a German design, by The Hockley Chemical Co., Ltd., Hockley Hill, Birmingham, 18, who are also the sole agents in the United Kingdom for the range of Lacromatic metal-finishing processes. A rubber-lined container indicated at A is U-shaped in section, and is of welded-steel construction. It is mounted on compression springs, also heavy-duty C-type flat springs, and with this arrangement it can vibrate freely, under the influence of a motor-driven shaft which carries out-of-balance weights.

As a result, the container oscillates through an elliptical path and the chips and components contained therein not only move relative to each other but also rotate slowly, as a complete mass. A diagrammatic section through the container, showing the chips and a number of parts, is given in Fig. 2, where the bold dotted line indicates the slow rotation of the complete mass, in an anti-clockwise direction. Since the container does not rotate, the loading and emptying apertures are always in the same position, and the unit therefore readily lends itself to inclusion in a production line. A fully-automatic version is available with provision for delivery of chips and parts to the container by way of a conveyor belt. During operation, the charge slowly gravitates to the exit end of the container, whence it is delivered on to a vibrating screen which separates the chips from the parts and returns the former to the loading conveyor, for re-use.

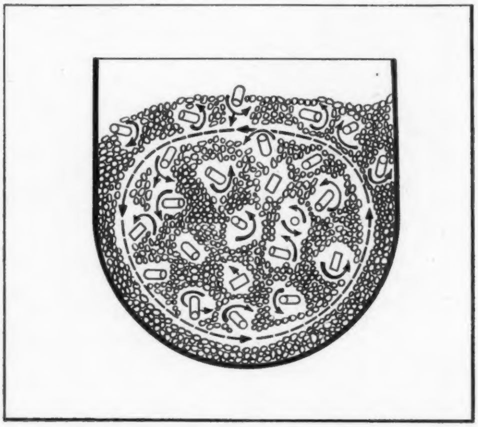


Fig. 2. Diagrammatic sectional view through the container of the machine shown in Fig. 1. In addition to vibrating, the chips and parts rotate slowly, as a complete mass

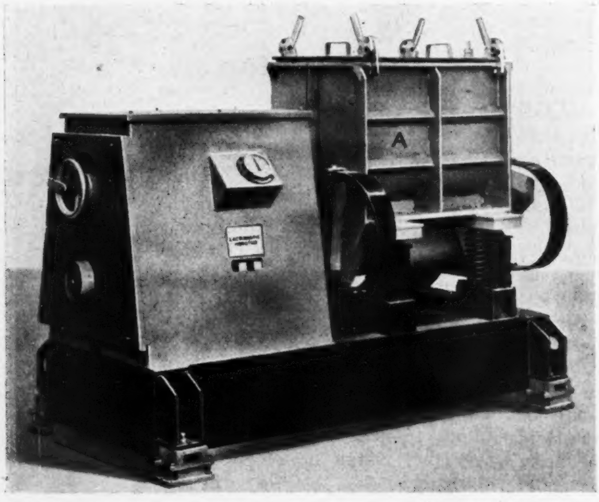


Fig. 1. General view of the Lacromatic Vibrator for deburring and polishing a wide variety of metal parts

It is stated that the action of the Lacromatic Vibrator avoids damage to the parts being processed, as a result of contact with each other, and greatly minimizes the risk of them becoming entangled. For example, when small circlips are processed in conventional barrelling equipment,

they tend to become interlocked, and, as a result, the time required for the operation is increased considerably. When these items are deburred in a Lacromatic Vibrator, however, there is little or no entanglement, and the processing time is typically about $\frac{1}{16}$th of that required for conventional barrelling.

In Fig. 3 are shown two steel stampings for a well-known design of bicycle brake, in the " before " and " after " condition. On these parts, all the surfaces and edges are required to be smoothed and polished, and when conventional barrelling was employed it was found that unless the process was carried out at a slow rate there was a tendency for the stampings to damage each other as a result of repeated and severe impacts during treatment.

With the Lacromatic equipment, however, the parts do not contact each other and the processing time is approximately $\frac{1}{15}$th of that previously needed. Other items which have been successfully treated, in reduced processing times as compared with conventional methods, include gears, springs, bearing cages, die castings, a wide variety of externally and internally threaded parts, and various types of cast handles, in ferrous and non-ferrous materials. For treating die castings, it is recommended that preliminary processing with chips and a mild abrasive compound should be followed by a second treatment with steel balls and a burnishing compound. With the latter treatment, the lustre finish required for subsequent plating of the part is obtained in approximately $\frac{1}{8}$th of the time required for conventional barrelling.

Where there is no mains water supply, or if drainage facilities are not readily available, the vibrator may be used dry, with wooden cubes or pegs and a specially-prepared polishing compound which is marketed under the trade name of Lacron DP.

The control system of the unit provides for automatic starting and stopping, by means of a timer, and a switch is also incorporated whereby the drive, and consequently the direction of flow of the mass of chips, can be reversed. Steplessly-variable control is provided for the main driving motor, and a tachometer is incorporated to indicate the operating speed. Large parts, such as camshafts, can also be processed with the equipment, and for these applications the work is held in a simple jig and the direction of flow of the chips is reversed after a predetermined period.

Fig. 3. **Typical steel stampings, for a well-known make of bicycle brake, are here shown before and after being processed in the Lacromatic Vibrator**

" SPARK-PUMP " FOR INTERNAL COMBUSTION ENGINES.—The Clinton Engine Corporation, U.S.A., have recently developed a new ignition system for use on internal combustion engines. Known as the PZT system, it incorporates a unit known as a " spark-pump," and eliminates the need for a battery, make-and-break unit, coil, and condenser. Two small-diameter PZT ceramic rods are arranged end for end, with a small gap between, and are enclosed in a plastics case. The rods are polarized by the application of a high voltage, and are thereby rendered piezoelectric, that is to say, capable of producing electrical energy as a result of applied pressure.

In the present stage of development, the device is " squeezed " mechanically, by means of a suitable lever arrangement driven from the engine, and the electrical energy produced is directed to the sparking plug by way of a timing switch. It is stated that voltages as high as 30,000 can be obtained, but the normal operating range is between 16,000 and 21,000 volts. At this rating, the life of the unit between re-charges is approximately 500 hours, at a " squeeze " frequency of 3,600 per min.

It is envisaged that with further development it might be possible to utilize the compression within the cylinder to " squeeze " the PZT unit, and thus eliminate the mechanically operated lever arrangement mentioned above.

Concessionaires in this country for the Clinton Engine Corporation are the Lambretta/Trojan Organization, Trojan Works, Purley Way, Croydon, Surrey.

Mechanized Assembly of Rocker Arms

By HERBERT CHASE

Rocker arms for 1960 Buick engines are die cast in aluminium alloy, mainly with the object of reducing inertia forces. To permit economical assembly of the rocker arm components, the automatic machine here described was developed, on which the various components are fed to their assembly points from hoppers and magazines.

The rocker arms are cast close to the required size and with a cored central hole that can be finished by a simple broaching operation. Two hardened steel inserts, shown in Fig. 1, with rocker arms, are the parts assembled by the equipment mentioned. One insert is a cold-headed pad with a stem which is pressed into a drilled hole in the rocker arm. In operation, this pad bears against the valve stem. The second insert is a small hardened steel cup with a spherical seat, which is pressed into a recess in the push-rod end of the rocker arm, and then staked. Finishing operations on the rocker arms are performed on 11 machines. The cuts are light, since little metal need be removed and high speeds can therefore be employed.

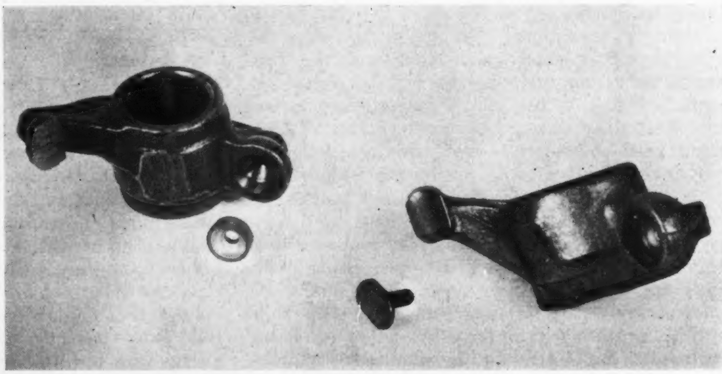


Fig. 1. (above) Aluminium alloy rocker arms for a Buick engine, and two hardened steel components which are pressed into mating holes on an automatic machine

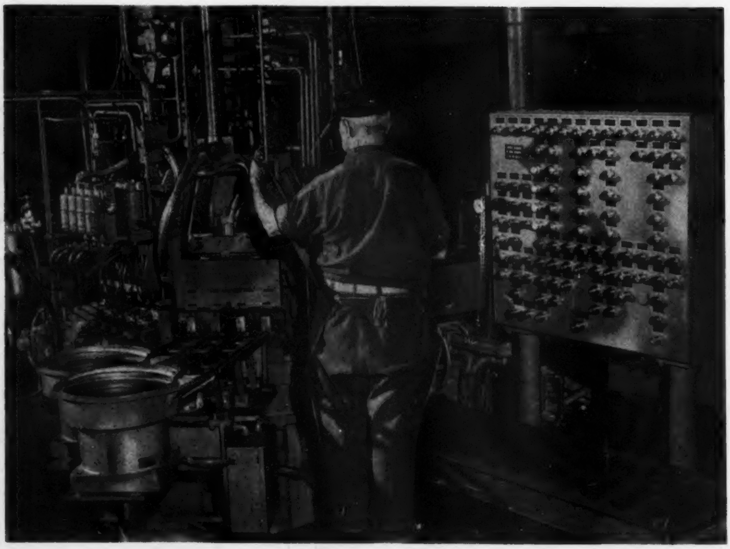


Fig. 2. (left) Four parallel magazines, loaded by the operator, deliver rocker arms to supporting pins at the first station of the Impco assembly machine. Push-rod seats, fed from hoppers, are pressed into the mating holes of the rocker arms at the second station

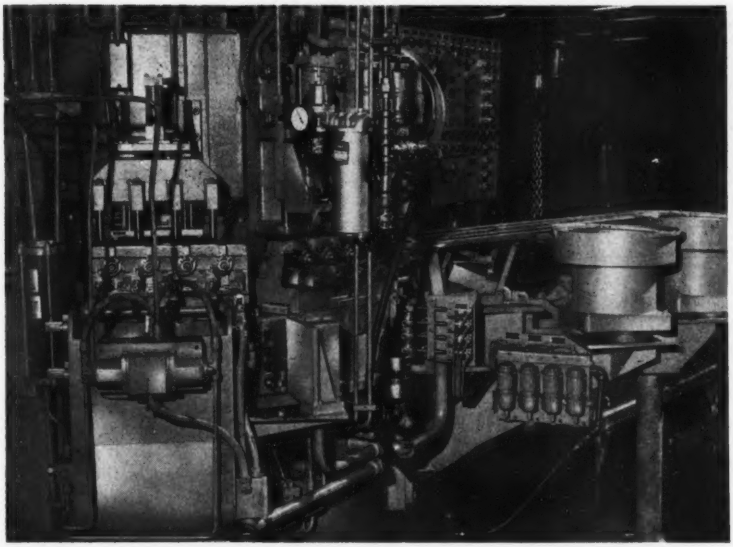


Fig. 3. At the third station, (centre) four staking tools, actuated by small hammers, secure the push-rod seats in position. At the fourth station, (left) supports are raised under the rocker arm bosses in readiness for pad insertion

Machined rocker-arm castings are hand-loaded into four Syntron hoppers which supply the Impco assembly machine shown in Fig. 2. Operation of this 8-station indexing machine is completely automatic, apart from the bulk loading of small parts into hoppers and the hand loading of magazines from which rocker arms are delivered to the first station. At each station of the machine, similar operations are performed on four rocker arms at the same time.

Each rocker arm is loaded over a pin that enters the large central hole, one arm being advanced from each of the four hand-loaded magazines that are arranged side by side. At the first indexing movement, the four rocker arms are moved to the second station, which is seen at the left in Fig. 2. Each of the two hoppers at this station feeds two track magazines so that there is a magazine for each of the four fixtures. A magnet on each fixture picks up a spherical seat from the inner end of the corresponding magazine track, carries it to a point above a rocker-arm recess, and then presses it into the recess. A single small hydraulic ram exerts the necessary force on all four fixtures and then retracts the inserting punches.

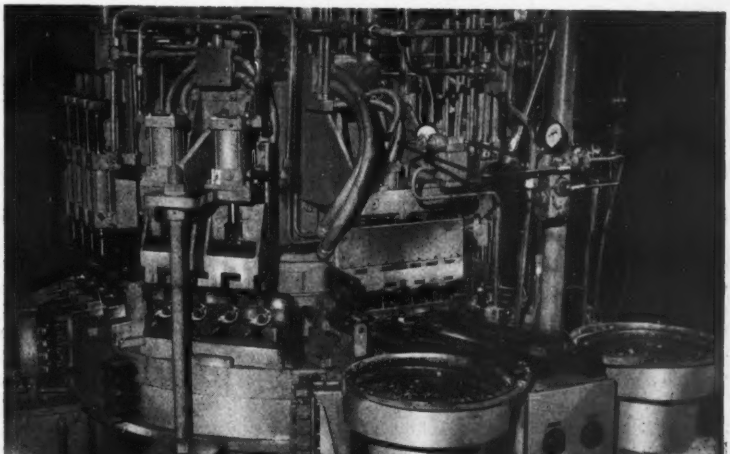


Fig. 4. Each hopper at the right feeds pads into delivery tracks. From each track, one pad is picked up by a magnet at every cycle and is placed with its shank in the mating hole of a rocker arm. At the sixth station (left) the pads are pressed home

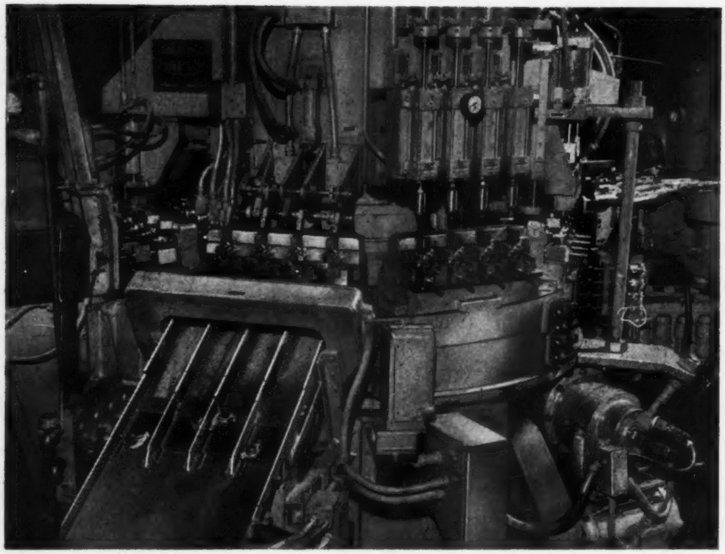


Fig. 5. At the seventh station (right) each rocker arm is subjected to a bend test by the application of a 1,000-lb. load. Assembled rocker arms are ejected and fall down the chutes at the eighth (left). If any component of an assembly is missing, a gate is opened to direct the rocker arm into a reject box

After the four fixtures have advanced to the third station, seen at the centre in Fig. 3, four punches stake the seats to the rocker arms, each at three points. Each punch is actuated by a separate automatic riveting hammer. At the fourth station of the machine, the four rocker arms are repositioned to bring the valve pusher end of each arm above an anvil. Each anvil bears against the under-side of the boss on a rocker arm, as seen at the left in Fig. 3, and there is a central hole in each boss to receive the shank of the pad.

At the fifth station, as seen at the right in Fig. 4, there are two Syntron hoppers for feeding pads into four track magazines, with the shanks pointing downwards. At the inner end of each magazine, a magnet picks up one pad at a time, transfers it to the correct position relative to the rocker arm, lowers the shank into the mating hole in the arm, releases the pad, and then retracts in readiness for the next cycle of the machine.

Thus each rocker arm carries a pad when it is advanced to station 6 (seen at the left in Fig. 4). Here, four punches descend to press the pads firmly against the mating boss surfaces. Each of the punches is slotted on the end to position the pad so that its long axis is parallel to the axis of the central rocker-arm hole before it is pressed home. The shanks are a press fit in the holes, to ensure that the pads will not shift in service.

At the seventh station of the machine, seen at the right in Fig. 5, each rocker arm is located below a punch. Cams apply jaws to the rocker arms at points where they clear the lower sides of the pad bosses. When the punches descend they apply a force of 1,000 lb. to each pad. As the opposite end of each rocker arm rests on a fixed block, the arm is subjected to a bending stress much higher than will be imposed in service. This bending test provides a check for the presence of flaws in any casting that might be sufficient to cause breakage in operation.

Limit switches at the final (eighth) station of the machine are so arranged as to cause rejection of any rocker arm if, through faulty action at any preceding station, either a spherical seat or a pad insert has not been assembled. If such a part is missing, these switches cause a gate to open in one of the discharge chutes seen at the left in Fig. 5. If the rocker arm assemblies are complete, the gates remain closed. Four assemblies slide down the chutes at the same time when they are automatically pushed off the supporting pins. Correctly assembled arms slide down the chutes into boxes. Rejects fall through any gate that has been opened and drop into a separate box.

Only one man is required to keep the magazines and the hoppers loaded and to check the machine for incorrect functioning. As the machine is designed to make 1,800 cycles an hour and complete the assembly and testing of four rocker arms at each cycle, output is high and the labour charge extremely low.

Production of Crude Steel in Japan during the four months of July to October last averaged 1,854,000 tons. For the full year 1959 the monthly average was 1,364,000 tons, for 1958, 994,00 tons, and for 1957, 1,031,000 tons.

Automatic Work Loading Unit for the Churchill Type BW Cylindrical Grinder

In the accompanying illustration is shown a close-up view of a type BW cylindrical grinder built by The Churchill Machine Tool Co., Ltd., Broadheath, near Manchester, fitted with an automatic work loading and unloading unit, and set up for grinding flanged components on a fully automatic cycle.

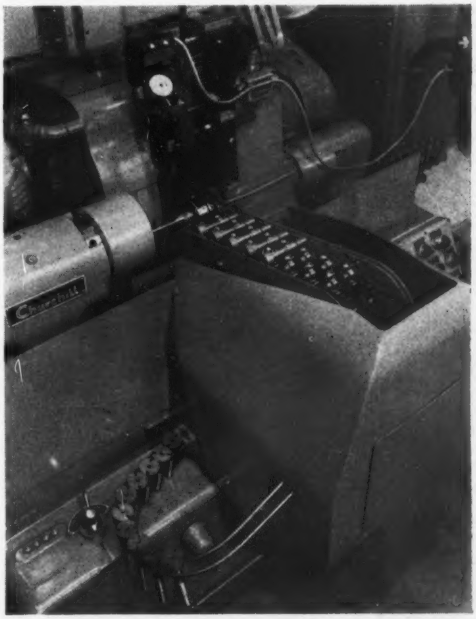
The work handling unit takes the form of a continuous, indexing-type, chain conveyor, fitted with a number of cross plates, which carry pairs of spring clips. Workpiece blanks are loaded by hand into the clips at the top of the conveyor. At the end of a grinding cycle, the entire conveyor unit is pivoted towards the wheel by an air cylinder, with the result that one pair of clips is passed over the ground component, which is held between the work-head and tailstock centres. The tailstock centre is now retracted, and at the same time the ground piece is moved clear of the work-head centre by spring action, whereupon the conveyor is indexed to the left, as viewed from the work-head side, by another air cylinder. In this way, the ground part is brought clear, and a fresh blank is moved into line with the work-head and tailstock centres.

When the tailstock centre is advanced to the working position, the blank is pushed endwise into engagement with the work-head centre. Next, the conveyor unit is pivoted in the opposite direction, and during this movement, the spring clips are pulled off the blank. The grinding cycle is then automatically started. Ground components are carried round beneath the conveyor, and at each indexing motion, one part is removed from the clips by a stripper block attached to a spring steel arm, and is discharged from the machine down a pair of guide bars, as may be seen in the figure. With the arrangement described, the need for separate work loading and unloading arms and their associated operating mechanisms is avoided.

Grinding of three diameters and a blending radius portion on the component is carried out with a profiled wheel, by the plunge-feed method, rapid power traverse and a diminishing in-feed being applied to the wheel-head on an automatic cycle, which is controlled by an M.P.J. Electro-Sizing unit. At the beginning of the grinding cycle, the sizing unit is automatically moved downwards on a square-section guideway member attached to the tailstock, and the indicator head is then pivoted in a direction towards the grinding wheel to bring the measuring calipers into engagement with the work.

Dressing of the grinding wheel is carried out on an automatic cycle by a hydraulically-operated, template-controlled attachment, mounted on the wheel-head, which can be brought into use automatically when a pre-set number of components has been ground.

Details of the grinders in the Churchill BW range were given in MACHINERY, 96/1487—22/6/60. Charles Churchill & Co., Ltd., Coventry Road, South Yardley, Birmingham, 25, are the distributors for Churchill grinding machines in the home market.



Close-up view of a Churchill type BW cylindrical grinder equipped with an automatic work loading and unloading unit. Pivoting and indexing movements are imparted to the chain-type conveyor

The Phosphate-coating and Lubricating of Steel for Cold Extrusion*

By D. JAMES†

THE IDEA OF EXTRUDING STEEL COLD originated at the Neumeyer Metal Works, Nuremburg, in 1935, when a mild-steel blank was fed into a press which was being used for the production of cartridge cases from 0·60-in. thick brass. It was obvious, however, that it would be necessary to develop a suitable lubrication system, and the basis of such a system already existed in the form of phosphate coatings impregnated with various lubricants.

In the intervening period, considerable research and field-trial work has resulted in the development of phosphate coatings and lubricants which will permit the severe extrusions carried out today.

PHOSPHATE COATING

Without going into extreme detail, it may be of interest to discuss the nature of the reactions, and of the coating produced, in general terms.

When a piece of chemically clean steel is immersed in a typical zinc phosphate solution, coating takes place in the following manner:—Reaction occurs between the solution and the steel surface whereby the primary phosphate-phosphoric acid equilibrium is altered at the metal/liquid interface, with the result that insoluble heavy-metal phosphates are deposited.

A reaction intermediate takes place between:—

(i) $3Zn(H_2PO_4)_2 + 6Fe \longrightarrow Zn_3(PO_4)_2 + 2Fe_3(PO_4)_2 + 6H_2$,

(ii) $3Zn(H_2PO_4)_2 + 2Fe \longrightarrow Zn_3(PO_4)_2 + 2Fe(H_2PO_4)_2 + 2H_2$.

These reactions represent the extremes. With (i) all the dissolved ferrous iron goes into the coating, and with (ii) all the dissolved ferrous iron goes into the solution. The hydrogen is depolarized by simple oxidation:—

(iii) $6H_2 + 6O \longrightarrow 6H_2O$,

and if the depolarizing agent is also a sufficiently powerful oxidizing agent, then ferrous iron is oxidized out of solution:—

(iv) $2Fe(H_2PO_4)_2 + O \longrightarrow 2FePO_4 + 2H_3PO_4 + H_2O$.

It has been found in practice that zinc phophate coatings are very considerably superior to those of any other metal in assisting severe cold-working operations, and it is this type of process which is invariably chosen for application prior to cold extrusion. The coating formed consists predominantly of zinc tertiary phosphate ($Zn_3(PO_4)_2 4H_2O$), usually in the ortho-rhombic form. Various reasons have been put forward for the superiority of zinc phosphate coatings over others, but the most probable are as follows:—

(1) It has been proved beyond doubt that reaction takes place between the zinc phosphate coating and the lubricant bath in which the work is subsequently immersed. Specially developed reactive lubricants have been produced to take advantage of this property, and it is known that the zinc soaps formed in conjunction with zinc phosphate coatings have much better lubrication characteristics, under high unit pressures, than those of alternative metals.

(2) The crystal structure produced by an accelerated zinc phosphate solution possesses plastic properties under the conditions of temperature, pressure, and shear stress which exist when severe cold working is being performed. The behaviour of the coating is probably similar, therefore, to that of a very high viscosity lubricant. This behaviour would account for the property possessed by adherent zinc phosphate coatings of following the plastic deformation of steel even where it is forced to flow over die contours of very small radii.

(3) Under severe cold-working conditions, while some coating is removed, most of it is converted into a glass-like film. Microscopic and X-ray examinations of such films produced by cold working, which have been carried out in Germany, suggest that this condition is due to the fragmentation of the crystal aggregates and the instantaneous fritting together of these fragments, into a film which is strongly adherent to the base metal.

(4) Zinc phopshate processes have certain operational advantages in that the massive coating generally required for cold extrusion can be formed quickly, and the working temperatures are generally lower than those for iron or manganese phosphate solutions. The ultimate crystal structure is

*Abstract of the first part of a paper presented at the recent Sheffield conference on Cold Extrusion of Steel, which was organized by the Institute of Sheet Metal Engineering.

† The Pyrene Co., Ltd., Metal Finishing Division.

also far less sensitive to previous pickling operations. Zinc phosphate solutions are also the most economical to operate.

Fig. 1-4 show crystal formations deposited on pickled steel surfaces by various types of phosphating solutions. It is possible to deposit phosphate coatings varying considerably in thickness. Due to the crystalline form of the coating and its comparatively soft nature, however, also the fact that the original metal surface cannot be taken as a datum, it is usual, when measuring coatings, to determine the weight deposited per unit area rather than the actual thickness. A coating weight of 1·0 to 1·5 gm. per sq. ft. corresponds approximately to a thickness of 10 to 15 microns.

Coating weight is normally determined by processing a sample piece of steel, of the same specification as that used for the components being treated. The sample is processed through a sequence of operations similar to that used in production as far as the phosphating stage, and is then water-washed and dried. After the sample has been carefully weighed, the coating is completely removed by immersion in either hot caustic soda or well-inhibited cold hydrochloric acid. After further washing and drying, the sample is reweighed and the coating weight is thus obtained.

Considerable difference of opinion exists concerning the optimum coating weight of zinc phosphate to be applied prior to cold-extrusion. Fischer has stated that he had no evidence of difficulties due to the coating being too thick, but only of trouble being experienced when it was

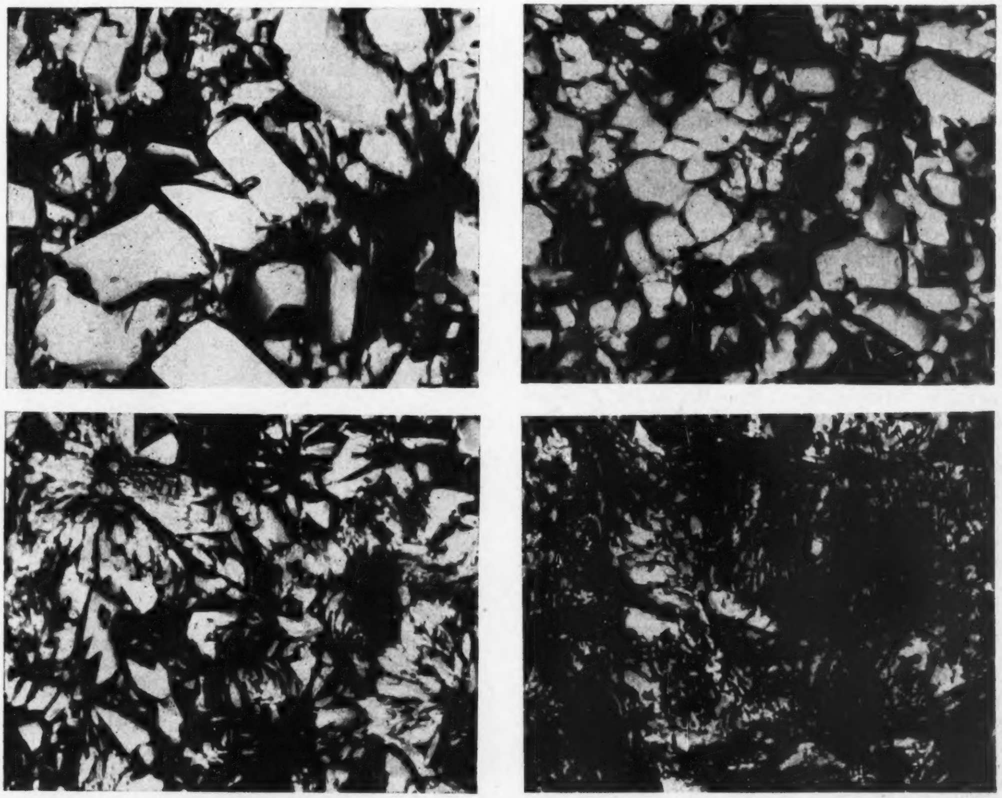


Fig. 1-4. Photographs at 284× magnification showing the crystal formations deposited on pickled steel surfaces by various types of phosphating solutions. (top left) Manganese/iron phosphate. (top right) Iron phosphate. (lower left) Zinc/iron phosphate. (lower right) Zinc phosphate. ***(By courtesy of The Pyrene Co., Ltd.)***

TABLE 1. VARIATIONS IN COMPOSITION OF PHOSPHATE COATINGS OBTAINED FROM IRON-FREE AND IRON-CONTAINING SOLUTIONS

Analysis of phosphate coating	Phosphating bath free from Fe"	Phosphating bath containing 0·43 per cent Fe"
Per cent Zn	34·2	27·5
Per cent Fe"	7·1	10·4
Per cent PO_4	42·1	40·0

too thin. However, production experience has suggested that unduly heavy phosphate/lubricant films can introduce problems, particularly when components are being extruded at high production rates. Excess lubricant film, sheared off the slugs, packs into punch and die contours, and causes variations in the shape of the extruded component. Moreover, the use of excessively heavy coating and lubricant films is necessarily uneconomical.

There is no doubt that coating weights of a wide range have proved satisfactory in production, but bearing in mind such factors as severity of deformation, tool forms, and economics, it is suggested that a coating suitable for any extrusion could be selected from a range of 1·0 gm. per sq. ft. to 2·5 gm. per sq. ft. In practice, the thicknesses most commonly used appear to lie in the range from 1·0 to 1·5 gm. per sq. ft.

McKenzie and Rodger have studied the effect of zinc phosphate coating weights on extrusion pressures, covering a range from 250 mg. to 3 gm. per sq. ft. It was found that the total variation in pressure required to extrude slugs with coating weights within this range was only 5 per cent, and this variation was within the limits of reproducibility of the tests. They concluded, therefore, that tenacity and uniformity were more important than thickness or weight of coating. They also noted that no difference in surface finish was detectable on the finished extrusion, regardless of the coating weight.

While coating adherence is of supreme importance, it is obviously desirable in large-scale production also to have some excess of coating over the minimum necessary to obtain a low extrusion load. This excess gives some safeguard against variations in processing conditions, and is beneficial in ensuring a reasonable tool life, assuming other factors to be correct. Recently, very successful results have been obtained from zinc phosphate coatings of approximately 1·0 gm. per sq. ft. (range 800 to 1,200 mg. per sq. ft.). Such coatings are produced from solutions operating completely free from dissolved ferrous iron (see reaction iv). With such solutions, relatively finer crystal structure is obtained despite prior acid pickling, and the coatings have extremely good adherence to the base metal. A coating produced in this manner contains the highest possible proportion of zinc tertiary phosphate. The effect of varying proportions of ferrous iron in the phosphating bath on the composition of the coating deposited can be seen from Table 1, and Fig. 5 shows the stages in which a component is formed with the aid of the coating obtained from such an "iron-free" solution.

On two components, direct comparisons were made by extruding slugs with a phosphate coating of 2·5 gm. per sq. ft. and then extruding similar slugs with a coating of 1·0 gm. per sq. ft. The first component so tested was a cup formed by backward extrusion, and the reduction of area was 69·2 per cent, and the material, mild steel. With the heavier coating, the average press load for the run was 203·3 tons and with the lighter coating 202·5 tons, and there was no noticeable difference in the appearance of the extruded cups. At a different plant, another backward extrusion was carried out, and the press loads in this instance were 60·6 and 60·9 tons, respectively. Within the limits of experimental error, in these examples, there was obviously nothing to be gained by increasing coating weight over a nominal 1·0 gm. per sq. ft.

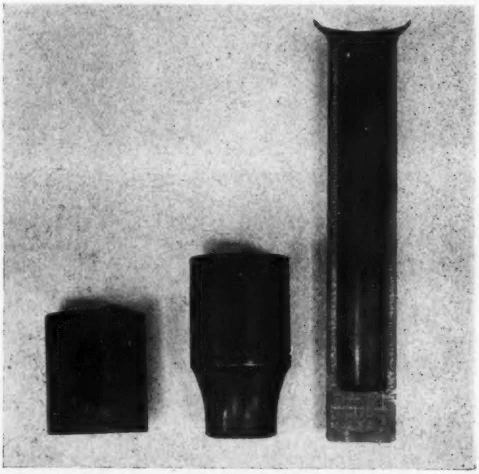


Fig. 5. A brake master cylinder produced by cold extrusion in two stages. After being annealed and pickled, the slug and the first stage extrusion are phosphate-coated in a zinc phosphate solution which is operated in the ferrous-iron-free condition. A reactive stearate lubricant is then applied. *(By courtesy of Aero Heat Treatments, Ltd.)*

TABLE 2. COEFFICIENTS OF FRICTION (μ) FOR SULPHONATED TALLOW AND SODIUM STEARATE ON PLAIN AND PHOSPHATED STEEL UNDER VARYING CONDITIONS

Unit Pressure (lb. per sq. in.)	Lubricant system	μ
1,250	Plain steel + sulphonated tallow	2·7
	Plain steel + sodium stearate	1·8
	Phosphated steel + sulphonated tallow	0·9
	Phosphated steel + sodium stearate	0·6
2,500	Plain steel + sulphonated tallow	1·9
	Plain steel + sodium stearate	0·4
	Phosphated steel + sulphonated tallow	0·9
	Phosphated steel + sodium stearate	0·25
5,000	Plain steel + sulphonated tallow	1·8
	Plain steel + sodium stearate	1·8
	Phosphated steel + sulphonated tallow	0·65
	Phosphated steel + sodium stearate	0·55
12,500	Plain steel + sulphonated tallow	0·9
	Plain steel + sodium stearate	0·9
	Phosphated steel + sulphonated tallow	0·5
	Phosphated steel + sodium stearate	0·25

Successful extrusion has also been carried out without a pickling operation prior to phosphating. In these circumstances, the coating weight obtained is only in the region of 600 mg. per sq. ft., but the indications, so far, are that tool life has not suffered on this account.

LUBRICANT

Various tests have been devised in an endeavour to determine the best lubricant for use when steel is to be cold extruded. In one such test, zinc phosphate coated steel panels impregnated with various lubricants were compared with plain steel panels treated with similar lubricants. The phosphate coating weight was 2·3 gm. per sq. ft. and the coefficient of friction (μ) was determined at unit pressures ranging from 1,250 to 12,500 lb. per sq. in. (It should be noted that the highest unit pressures used in these tests were only approximately one-fortieth of those which might be encountered in actual extrusion operations. The difficulty of synthesizing actual extrusion conditions in tests for coefficient of friction is, of course, the great weakness of such tests.) The results obtained in this series of determinations, for two well-tried lubricants, sulphonated tallow and sodium stearate, are shown in Table 2. In these tests, the samples were moving at speeds of approximately 0·3 to 0·5 in. per min.

Reference has been made to the reaction which takes place between the zinc phosphate coating and certain types of lubricant, and it is significant that for virtually all the cold extrusion of steel now being carried out on a production scale, a zinc phosphate coating is employed in conjunction with a highly reactive stearate-based lubricant, to ensure the maximum formation of zinc soap.

It is believed that only the soaps of the alkali metals and of a few organic bases allow metathesis to take place between the lubricant and the coating, and experiments show that stearates and palmitates behave more favourably in this respect, than do soaps with smaller molecules.

Experimental evidence is available to show the extent to which hydrophobic metallic soaps are formed when phosphate-coated steel is introduced into solutions of alkali-metal soaps, and the following notes show typical results obtained with steel panels. These panels were treated in the normal sequence of operations used for steel components prior to extrusion. The different components of the lubricant "sandwich" so formed are fractionated analytically as follows:—

(i) The water-soluble sodium soaps are removed by careful washing with warm water.

(ii) The hydrophobic zinc soap is removed by a suitable mixture of solvents.

(iii) The residual phosphate coating is determined by one of the methods mentioned earlier.

The accurate determination of the various fractions of the lubricant film calls for a specialized technique. The problems encountered have, however, been overcome by suitable laboratory procedures and Table 3 shows typical fractions determined by these methods.

The degree of combination which will take place between the coating and the lubricant is considerably influenced by the lubricant temperature and the pH value of the solution. Obviously, work must be allowed to remain in the lubricant until the reaction has achieved a suitable level. With improvements in techniques which enable the degree of reaction to be measured with considerable accuracy much work is currently being carried out to determine the optimum reaction conditions for soap type lubricants.

TABLE 3. TYPICAL RESULT OF A FRACTIONAL ANALYSIS OF THE LUBRICANT FILM ON A SLUG PREPARED FOR COLD EXTRUSION. THE WEIGHT OF SOAP DEPOSITED ON A PLAIN STEEL COMPONENT WITHOUT PHOSPHATE COATING IS ALSO INDICATED

	Phosphate-coated steel (mg. per sq. ft.)	Plain steel (mg. per sq. ft.)
Water-soluble soap	270	230
Reacted metal soaps	540	Nil
Residual phosphate coating	1,080	Nil

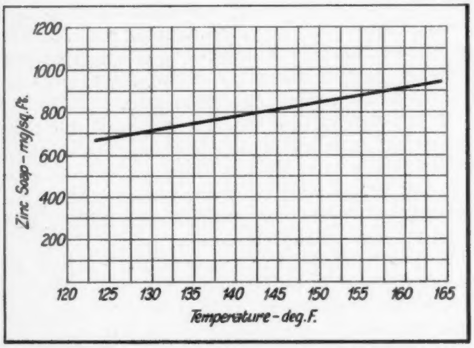


Fig. 6. A graph showing the relationship between the degree of reaction and the lubricant temperature when applying a reactive stearate lubricant to a zinc-phosphated surface. Free acidity of the lubricant was zero and immersion time was kept constant at 8 min.

Fig. 6 and 7 show the effect of temperature and of variations of free acidity of a typical proprietary lubricant applied to zinc phosphate coated steel.

From the foregoing it will be evident that to obtain the best possible lubricant film for use under conditions of very high unit pressures it is necessary to study all these effects and to give them due consideration. In practice, these are factors which will have been very thoroughly investigated by the suppliers of the coating chemicals and the lubricant, and it is well worth while, therefore, to make every effort to ensure that these products are used under the conditions recommended. To this end, it is proposed to describe in detail the different stages through which a steel slug will normally pass after it has been annealed, and before it is loaded into the extrusion tools.

PROCESSING SEQUENCE

The term "chemically clean" has been used to denote the condition in which it is required to present the steel surface to the zinc phosphate solution. In this context, the term is meant to indicate a steel surface completely free from grease, rust or scale and, of course, normal shop soiling.

To ensure such chemical cleanness, and also because an acid pickle is usually considered desirable, even on scale-free surfaces, to ensure that the coating weight deposited will not be unduly low, the following sequence of operations has become virtually standard:—

(1) Alkali degrease. Hot alkali cleaner.
(2) Rinse. Cold running water.
(3) Acid pickle. Hot sulphuric or cold hydrochloric acid.
(4) Rinse. Cold running water.
(5) Rinse. Water, preferably hot.
(6) Zinc phosphate solution. Proprietary process—hot.
(7) Rinse. Cold running water.
(8) Conditioning rinse. Proprietary process—hot.
(9) Lubricate. A stearate-based material in hot solution.
(10) Dry off. Air drying is frequently adequate.

The requirements and precautions to be taken at each stage are as follows:

STAGE 1—ALKALI DEGREASING. For degreasing, one of the many alkali degreasing materials available is employed. These materials may be classified as light-duty cleaners, for the removal of light oils, handling grease and soils which are not particularly tenacious; medium-duty or general-purpose cleaners, which are effective for most of the oils and greases likely to be encountered in this field; and heavy-duty cleaners, which are particularly recommended for removing temporary corrosion protectives, such as those based on lanoline.

The final choice of cleaner, therefore, depends on the nature of the grease film on the work, and in the interests of economy a light- or medium-duty type should be selected provided that it is adequate for the purpose.

All immersion-type alkali cleaners give the best results at fairly high temperatures, generally 180 deg. F. or above. Recent developments have resulted in the introduction of low temperature alkali cleaners for application by spraying, but for

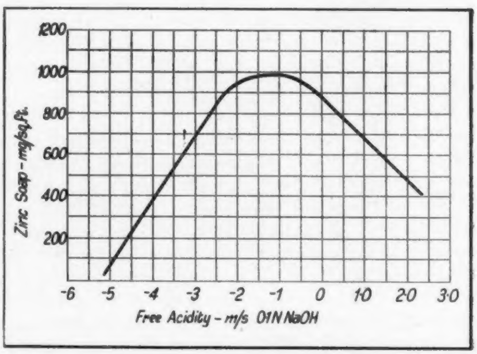


Fig. 7. A graph showing the relationship between reactivity and free acidity (pH) when applying a reactive stearate lubricant to a zinc-phosphated surface. Temperature was kept constant at 150 deg. F., and immersion time at 8 min.

the purpose under discussion, the added complications involved in installing spray cleaning equipment would not appear to be justified.

The strength of the alkali cleaner is maintained at the recommended level by carrying out, at reasonable intervals, a simple titration against a standard acid. By reference to a chart or table the required alkali addition can be at once determined. A correctly designed alkali degreasing tank should have a weir-type overflow to ensure the continuous removal of any oil layer on the surface.

STAGE 2—WATER RINSING. After it has been degreased, work should be washed in clean cold water, to avoid carry-over of alkali into the acid pickling section. A continuous water flow for the rinsing stage is strongly recommended.

STAGE 3—ACID PICKLING. For the acid pickling stage, sulphuric acid, usually used at a strength of 10 to 15 per cent and a temperature in the region of 170 deg. F., is generally favoured. Some companies, however, prefer cold hydrochloric acid pickling and there is no evidence that the use of either of these acids influences the ultimate coating to any material extent. From some black bar stock, also from certain low-alloy steels, the scale is best removed by the use of inhibited cold 50 per cent hydrochloric acid.

If the plant is not arranged for automatic operation, it is possible that work may be allowed to remain in the acid for unduly long periods with consequent over-pickling. In these circumstances, the use of an inhibitor in the acid is strongly recommended.

Proprietary pickles have been marketed which attack the base metal very viciously, and if such pickles are employed, unduly coarse phosphate coatings with very high coating weights are subsequently obtained. These coatings offer no advantage for the extrusion operation, and the economics of the pickling and phosphating operations are affected adversely.

In addition to controlling the strengths of acid pickles, it is desirable that the ferrous iron contents of the baths should be regularly determined. In this way, it is possible to decide when to discard the pickle liquor, without waiting for efficiency to fall below acceptable limits. For a typical plant, hot sulphuric acid is employed and is discarded when the iron concentration reaches 5 per cent.

STAGE 4—WATER RINSING. The carry-over of pickling liquors into phosphating solutions is definitely to be avoided, as far as is practicable. Moreover, contamination of the rinsing bath by ferrous salts also produces undesirable results. It should be noted, too, that the work can be contaminated with highly reactive ferric compounds resulting either from oxidation of the ferrous compounds, or from incipient rusting of the work, due to excessive rinsing dwell.

These troubles can be avoided by adequate rinsing in clean flowing cold water immediately after the acid pickling stage.

STAGE 5—WATER RINSING. Further clean water washing is next carried out, and there should be no undue delay at the rinsing stages. If this second rinse is operated hot, the work can be transferred to the subsequent phosphating stage at approximately working temperature.

To ensure that acid carry-over is not taking place, it is advisable to perform routine contamination checks on this second rinsing tank.

STAGE 6—PHOSPHATE COATING. For reasons already indicated, a proprietary zinc-phosphate solution is employed to produce the coating. This solution may be intended to operate with a small ferrous iron content, in which case the only chemical control necessary is that of total acid determination.

Solutions operated in the ferrous-iron-free condition are usually so maintained by means of the presence of free nitrite in the solution. High-strength nitrate-accelerated solutions frequently generate sufficient nitrite to ensure complete freedom from ferrous iron. However, from time to time it may be necessary to make separate additions of small quantities of sodium nitrite.

While present-day techniques make it possible to deposit crystalline zinc phosphate coatings from temperatures as low as ambient, the type of coating best suited for extrusion work is obtained from solutions at temperatures between 180 deg. F. and 200 deg. F.

All zinc phosphate solutions produce sludge, as a necessary by-product of the reaction, which settles to the bottom of a correctly designed process tank and forms part of a self-regulating mechanism whereby free acidity is maintained constant even when some input of pickling acid occurs. The area at the bottom of the process tank should be free from convection currents, to ensure that the sludge settles easily, and is not disturbed during processing.

When it becomes necessary to clean out a process tank, the clear liquid above the sludge layer is pumped over to an adjacent rinsing tank, which has previously been emptied, and the sludge is removed. The phosphating solution is then returned to the process tank, the working level is adjusted, and after the solution has been tested, chemical is added to restore the strength of the solution.

Suitable paper-band filters are now available which will continuously filter a phosphating

solution. In conjunction with these filters, it is necessary to use process tanks with conical bases, the angle of the cone being not less than 60 deg., to ensure that the sludge formed in processing will fall freely. The sludge-containing solution is pumped to the band filter, and subsequently returns to the process tank by gravity.

STAGE 7—WATER RINSING. After phosphating, most of the surplus processing chemicals are washed from the surface in clean cold running water, to reduce contamination at subsequent stages of treatment to a minimum.

STAGE 8—SURFACE-CONDITIONING RINSE. It is normal to immerse the phosphate-coated steel in a conditioning rinse prior to lubrication. This rinse is operated at a pH value similar to that of the lubricant to prevent variations occurring in the latter due to carry-over. It is claimed that, since the surface of the slug is wet from the rinse when it enters the lubricant, the maximum possible reaction is obtained at the lubrication stage. It is certain that the use of such rinses, which neutralize any carry-over of acidity from the phosphating solution, prolong the useful life of the lubricant considerably.

STAGE 9—LUBRICATION. Since the use of sodium fatty-acid soaps as lubricants for the cold extrusion of steel is virtually standard practice, the following comments are based on the assumption that the lubricant is of this type.

Four variables must be considered in connection with the lubricant.

(*a*) Concentration.
(*b*) Free acidity or pH.
(*c*) Temperature.
(*d*) Immersion time.

Fat contents of between 3 and 6 per cent by weight have been found to be the most satisfactory for extrusion purposes, the exact strength for a particular application being usually determined experimentally, on the work in question. Inadequate lubricant films will obviously result in uneconomic tool life, while, as previously mentioned, a considerable excess of lubricant can prevent the component from being accurately formed. It is unlikely that difficulties of this nature will be experienced in the strength range quoted.

Six per cent, by weight, of fatty acid will probably not be provided by the equivalent weight of a proprietary lubricant, as a straight sodium stearate, or a sodium stearate/palmitate/oleate blend, is generally considered inferior as regards reactivity to a lubricant containing buffer chemicals designed to maintain a constant pH value. Rust-inhibiting materials are also commonly included in the lubricant. For these reasons, proprietary lubricants are often supplied with recommendations for use at strengths exceeding 6 per cent by weight of blended mixture.

The importance of the pH value of the lubricant has been mentioned. As the pH value rises, or, in other words, as the degree of alkalinity increases, the reaction between coating and lubricant is accelerated in the direction of zinc soap formation. Above a certain pH value, however, deposition of the metallic soap is prevented, and the solution begins to attack the coating.

Immersion time for reactive stearate-type lubricants is usually about five min., the amount of reacted soap obtained during the period being normally satisfactory. The lubricants commonly employed are not sufficiently alkaline to have a stripping effect on the phosphate coating. This statement does not apply, however, in the case of oxalate coatings, which are used instead of phosphates for coating austenitic steels, and have been employed with some success for experiments in connection with various aspects of the cold extrusion of stainless steel.

STAGE 10—DRYING LUBRICANTS. If the lubricant is to have the best pressure-film characteristics it is essential to dry off all surplus moisture. When the slugs are fairly heavy they will normally dry sufficiently from the retained heat. If forced drying is employed, the temperature should not exceed 350 deg. F.

An abstract of the remainder of Mr. James' paper will be published in a forthcoming issue of MACHINERY.

METHOD FOR IMPROVING THE FATIGUE STRENGTH OF BOLTED ASSEMBLIES. The fatigue strength of nut and bolt assemblies may be improved by a patented system, whereby a number of grooves is cut across the threads in the nut. Each of these grooves is parallel to the axis of the hole, but the base is inclined and extends from the approximate full depth of the thread at the register face of the member to zero depth at the rear face. In this way, the stiffness of the threads adjacent to the register face is reduced, and the stress is more uniformly distributed to the bolt throughout the threaded length of the nut.

Limited tests have been carried out by D.S.I.R., and indicate that the fatigue strength of assemblies which incorporate these grooved nuts may be about 14 per cent higher than when plain nuts are employed.

Patent rights for this system are held by the National Research Development Corporation, 1 Tilney Street, London, W.1, who are prepared to consider the granting of licences for its application.

Coventry Gauge Variable-angle Profile Milling Machine for Wing Centre-sections

THE MACHINE SHOWN IN FIG. 1 has recently been built by Coventry Gauge & Tool Co., Ltd., Fletchamstead Highway, Coventry, and supplied to Vickers-Armstrongs (Aircraft), Ltd., Weybridge, Surrey, for precision milling profile tongues at the ends of wing centre-sections for aircraft. The tongue follows the cross sectional shape of the centre section, and while milling is in progress, the cutter head is automatically swivelled in the vertical plane to produce a variable face angle. This centre section is built into the fuselage of the aircraft, and the machined portions engage with mating tongues at the ends of the wings to give high-strength joints which will withstand the stresses imposed by high-speed flight.

Built up from four sections, the cast iron bed has an overall length of 32 ft., and carries a column on which the cutter head saddle is mounted. A view of the machine from the rear is given in Fig. 2, and Fig. 3 is a close-up view of the column and cutter head. The column saddle has a maximum travel of 25 ft. on the bedways, the drive being taken from a variable-speed motor, controlled by a B.T.H. Emotrol unit, through a reduction gearbox, and finally through a spiral gear which meshes with a straight-tooth rack secured to the bed.

Steplessly-variable cutting feeds from 1 to 60 in. per min. are obtainable. Bolted and tenoned to the front face of the bed, the table is of built-up construction, and has precision-machined tenon slots in the top surface for accurately locating the work-holding fixture and fixing brackets for a plate-type cam which controls the movement of the cutter head saddle in a vertical direction, in accordance with the cross sectional shape of the centre section. Contact between a follower roller and this cam is maintained by an air cylinder, in conjunction with counterbalance weights for the cutter head saddle.

The cutter head is mounted on a re-circulating ball quadrant on the saddle, and the tilting motion is controlled by a second cam carried on brackets secured to the rear edge of the bed. Movements imparted to the follower roller by variations in the shape of this cam, while milling is in progress, are transmitted by a rack and pinion to a gearbox, which operates synchro and Magslip generators. Signals from these generators are transmitted by an electronic control system to a second gearbox, which is mounted at the rear of the quadrant, and serves to impart swivelling movements to the cutter head through a pinion and gear segment.

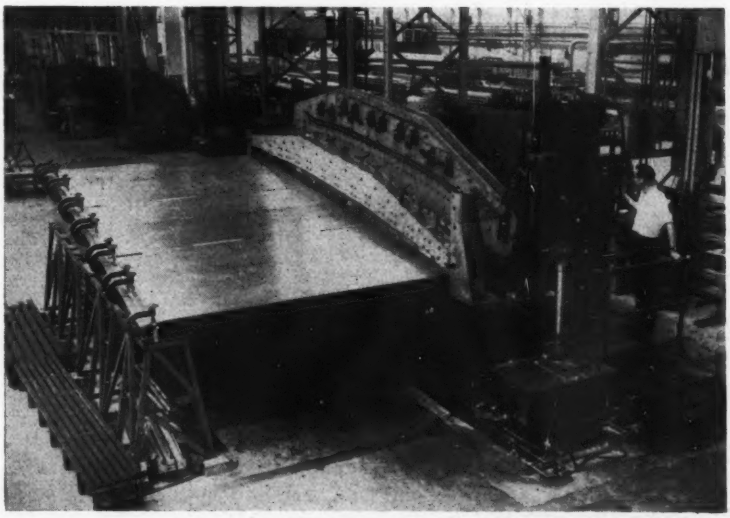


Fig. 1. This machine has been built by Coventry Gauge & Tool Co., Ltd., for Vickers-Armstrongs (Aircraft), Ltd., for profile milling tongues at the ends of wing centre-sections for aircraft. *[By courtesy of Vickers-Armstrongs (Aircraft), Ltd.]*

To avoid backlash in the gearing and the quadrant assembly, thereby ensuring the necessary rapid response between the movements

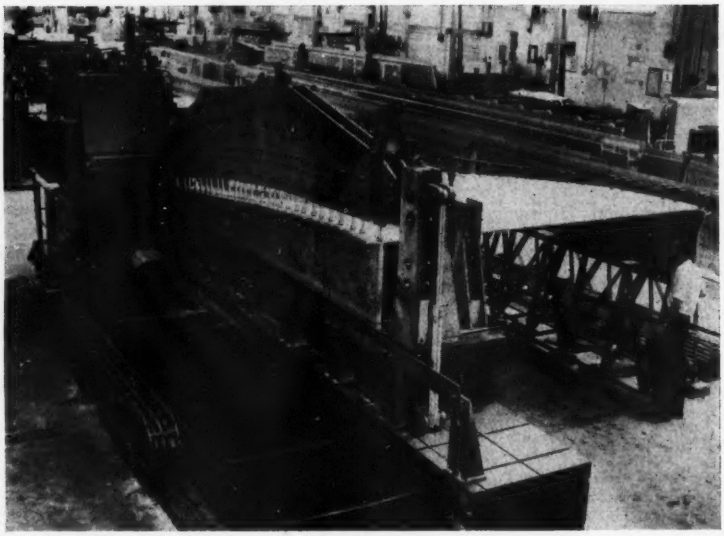


Fig. 2. Vertical movement of the cutter head saddle to suit the cross-sectional shape of the centre section is controlled by a cam mounted on the table. Swivelling movements of the cutter head for milling a variable face angle on the work, are controlled by a second cam mounted on the bed. *[By courtesy of Vickers-Armstrongs (Aircraft), Ltd.]*

of the cutter head and the follower, the component parts have been machined to exceptionally close tolerances, and fitting has been carried out to a very high degree of accuracy. It may be mentioned that the cutter head assembly, which weighs approximately 10 cwt., can be swivelled on the quadrant under a very light force applied by hand. For positioning the cams in relation to each other, to the required accuracy, machining of the tenon slots in the bed and table to take the fixing brackets, and boring of dowel holes in the brackets for locating the cams, was carried out to tolerances closer than those which are specified in B.S. 969-1953, relating to the accuracy of length gauges.

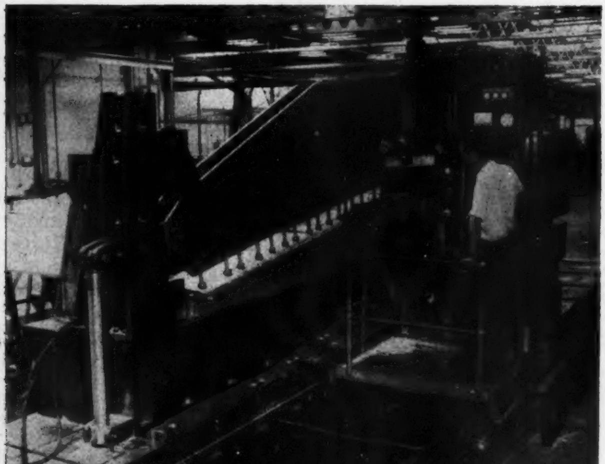


Fig. 3. Close-up view of the traversing column and cutter head assembly on the machine shown in Fig. 1 and 2. *[By courtesy of Vickers-Armstrongs (Aircraft), Ltd.]*

New Television Camera Tubes which are sensitive to infra-red and ultra-violet rays have been introduced by E.M.I. Electronics, Ltd., Hayes, Middlesex. The former enable objects illuminated by infra-red lamps to be observed. In addition, parts such as steel plates can be "seen" when heated to temperatures in excess of 450 deg. C. An oscilloscope can be used with the camera for measurement of temperature.

The principal purpose of the ultra-violet sensitive tube is to enable television pictures to be obtained from an ultra-violet microscope. It is pointed out that objects so small that the diameters approach the wavelength of light do not reflect the light and are not visible. They can, however, be observed with a special quartz lens microscope, and ultra-violet light, which has a shorter wavelength than visible light.

Gisholt Factrol 101 Tape-controlled Turret Lathe

ONE OF THE MOST INTERESTING MACHINES on the stand of the Gisholt Machine Co., Madison, 10, Wisconsin, U.S.A. (Wickman, Ltd., Coventry) at the Machine Tool Exposition held in Chicago last year was the Factrol tape-controlled turret lathe, which has a continuous-path magnetic-tape control system developed entirely by the company. A general view of this machine is given in Fig. 1, and it may be seen that the control equipment is housed in a cabinet at the left-hand end of the headstock, so that it forms an integral part of the lathe.

Machines are built in two sizes—of which the smaller is shown here—to swing 22·5 and 25 in. diameter over the bed-ways, and 15 and 18 in. over the cross-slides, and are normally equipped with standard chucks of 15 and 18 in. capacity, or with collet chucks to accept round bar up to 3·5 and 6 in. diameter.

Motors of 30 and 40 h.p. are usually provided, and drive the spindles through alloy steel gears, the 24 speeds ranging from 40 to 2,000 and 12 to 1,500 r.p.m. An optional range of 18 to 1,090 r.p.m. is available for the smaller lathe. The cross-slide and its saddle have strokes of 14 and 38 in. and 24 and 53 in. on the small and large lathes, respectively. The hexagon turret, also, has a lateral traverse, with a stroke of 8 or 10 in., and a longitudinal movement of 38 or 44 in. The maximum distances from the turret face to the end of the spindle are 50 and 67 in. and the smaller lathe occupies a floor area of 7 ft. by 22 ft. 7 in.

Hydraulic power is employed for the longitudinal and transverse feeds of the cross- and turret-slides, and for indexing the 4-position tool holder on the cross-slide, and the hexagon turret. Steplessly-variable feed rates up to 10 in. per min. for the transverse, and 20 in. per min. for the longitudinal movements of both slides, and fast traverse speeds of 100 and 200 in. per min., are available.

When indexing is carried out, the tool-holder or the turret is rotated through the smallest angle required to present the required tool to the work, and is monitored electrically to ensure that the cycle is stopped if the movement is not completed in accordance with the instructions on the tape.

Provision can be made for indexing the tool-holder and turret immediately the tools are clear of the work, to ensure that the non-cutting time is kept to a minimum. Safety units are incorporated in the hydraulic circuits which will stop the machine should excessive loads be imposed, and other instruments are used to measure the distances between the positions occupied by the slides and their programmed positions. Should the positioning error exceed a certain limit,

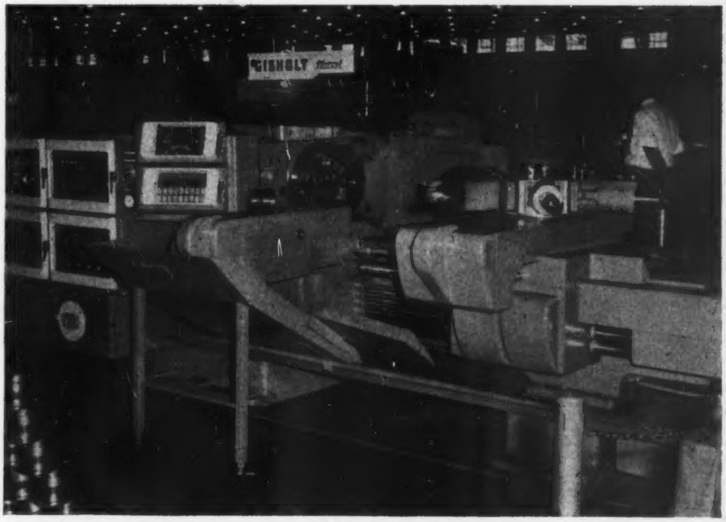


Fig. 1. General view of the new Gisholt Factrol 101 tape-controlled turret lathe. The air-conditioned cabinet to the left of the headstock contains all the transistorised control equipment

the machine is stopped automatically. For machining forgings, or other workpieces on which the amounts of material to be removed vary from one to another, provision can be made when preparing the programme for taking several successive cuts. These cuts can be arranged to leave a uniform amount of material on all surfaces, to be removed by a finishing pass.

The turret is provided with a coolant supply system, so arranged that only the tool in the operating position receives a supply. Coolant can also be introduced through a bore in the tool if required.

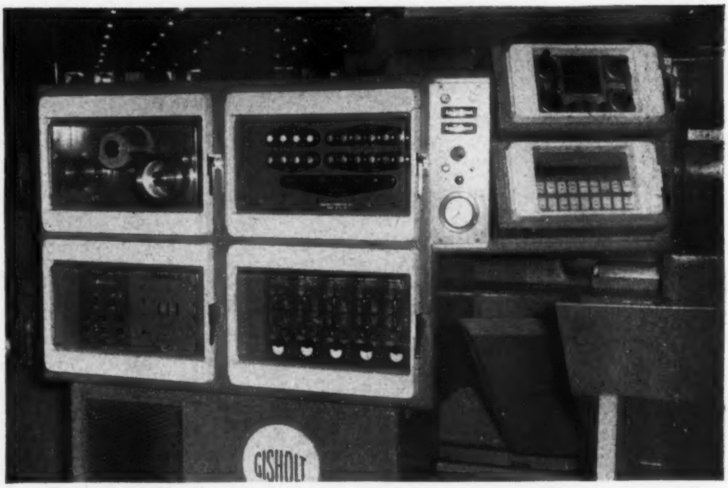


Fig. 3. Close-up view of the air-conditioned cabinet built on to the headstock of the Factrol lathe, showing the tape-reading unit at the upper left, and the panels whereby the machine can be manually controlled, if required

Two views of the workpiece produced with the set-up at the exhibition, sectioned to show the contour of the bore, are given in Fig. 2. Turned from solid steel bar, this part has a 4-diameter stepped bore, with chamfered edges, and an external contour comprising plain and tapered portions, end and shoulder faces, and a large radius blending one plain portion with the shoulder.

The cabinet containing the control equipment, which is attached to the headstock, is seen in more detail in Fig. 3. Completely transistorized, the equipment incorporates plug-in module boards, carrying static control elements, which ensure ease of maintenance and long life, and no vacuum tubes are used.

The control cabinet is dust-tight, and is fitted with an air-conditioning unit which maintains a moderate temperature and low relative humidity to safeguard the electronic components. At the left is seen the tape-reading head, which accepts a 2·5-in. wide magnetic tape whence command impulses control the movements of the four slides and other machine functions.

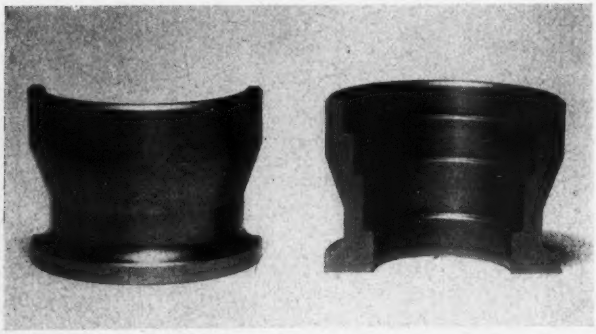


Fig. 2. Component produced on the Gisholt Factrol lathe, sectioned to show the stepped internal and tapered and radiused external contours, which were produced by single-point tools on the turret- and cross-slides

A panel at the right, set at an angle on the headstock, in such a position that it can be conveniently observed by the operator, has a series of push-buttons whereby all the machine functions can be manually controlled, if required. Above these push-buttons there is an illuminated scale with a 4-position selector switch. The scale is graduated in divisions representing 0·001 in., and it is supplemented by four dials, each graduated in 1-in. divisions. One switch setting, and a corresponding dial, relate to each of the four slides, and they indicate the position of the particular slide, relative to the zero setting, when the switch is moved accordingly.

The dials and switch can be employed to check the position of a tool under tape control, from the original data, and any slide can be adjusted by means of zero-shift buttons by any amount up to 0·25 in. in each direction. Behind the cabinet, hydraulic valves are mounted on manifolds, and transmission pipes, also tubing for air and water, and electrical cables, leading to the machine elements, are covered by telescopic sliding covers, so that the machine presents a very neat appearance.

TAPE PREPARATION CONSOLE

The preparation of tapes is carried out at a separate console, which may serve a number of machines and would normally be installed in the planning office. A close-up view of the console, showing the arrangement of the equipment, is given in Fig. 4, where the recording head is seen at the upper left. Beneath this head there is a set of 18 push-buttons which enables instructions concerning auxiliary machine functions to be recorded on the tape, the layout being similar to that of the manual controls on the panel in Fig. 3. The right-hand side of the console is divided into two similar panels, and beneath each panel there are two sets of push-buttons, for setting up information relating to the movements of the tool-holder and turret slides.

Since the panels at the right are similar, only that for recording instructions relating to the movements of the turret slides will be considered. Data in the form of numerical information describing successive positions of the tool point, in terms of *X* and *Y* co-ordinates, relative to the zero position, are prepared, together with particulars of the direction of movement of each slide, the feed rate, spindle speed, turret position, coolant supply, and the operation of auxiliary items such as die-heads, and collapsible taps. These data are prepared in the planning office, and are set out in the order in which the various stages are to be completed during the machine cycle.

At the console, the auxiliary functions are set up with the push-buttons at the left and recorded on the tape as directed. Instructions concerning the movements of the turret slides are set up with the aid of the appropriate push-buttons at the right, which are numbered from 1 to 9 and provide for the setting of two digits to the left, and three digits to the right, of the decimal point. The whole number and decimal digit buttons are distinguished by different colours. To set up a single movement of a slide, in one direction, it is necessary to turn a dial marked "angle and direction" to register the direction of movement, and press those buttons which define the end point of travel of the slide, taken from the data supplied.

When simultaneous movement of both slides is required, buttons of both sets are depressed. Having set up the information in this manner the operator presses another button marked "register enter," and a code representing the information is recorded on the tape. During recording, small five-digit counters, viewed through slots in the panel alongside the "angle and direction" dials, show the positions to which the tool slides will be moved as a result of the recorded data, and these readings can be directly compared with the instructions on the data sheet to check the correctness of recording. A dial, just above the push-buttons, provides for setting the feed rate or for the selection of rapid traverse, for each movement of the slide.

For programming tapers, the "angle and direction" dial mentioned above, is employed, and is set to the angle of the taper required, and the direction of movement of the tool. A dimension representing the end point of the travel of one of the slides is set up with the push-buttons, and the feed rate for this slide is also selected.

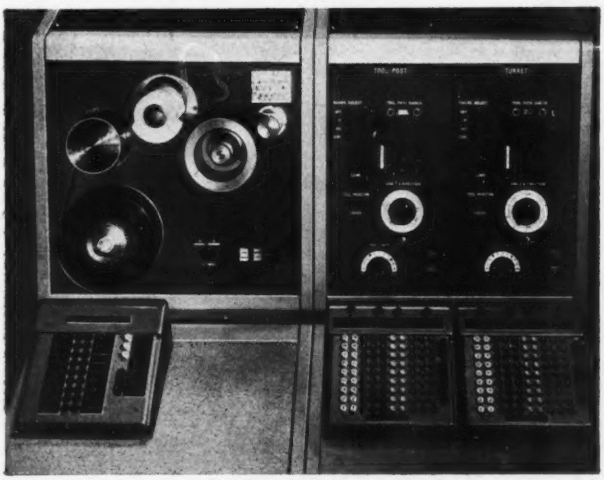


Fig. 4. Equipment on the tape-preparation console includes push-buttons (left) for auxiliary functions, and (right) for setting up information, to be subsequently recorded on the tape, relating to the movements of the turret- and cross-slides

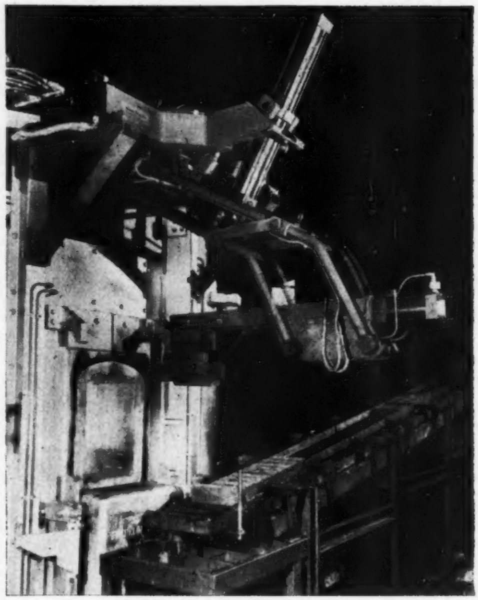
When the "register enter" key is subsequently depressed, electronic equipment within the console computes the feed rate required for the other slide, to produce the specified taper, and automatically records all the data on the tape.

DATA FOR MACHINING RADII

Instructions for the machining of radii from 0·025 to 100 in. can also be fed into the tape by means of a "tool path radius" selector dial and push-buttons at the top of the panel. The dial is turned until a number which is a function of the required radius is seen on a graduated drum through a viewing slot in the panel. Numbers engraved on the drum represent 0·001-in. increments up to 1 in., and three push-buttons marked × 1, × 10 and × 100, can be used to determine the position which the decimal point occupies in the dialled number. The direction of tool movement is also set on the "angle and direction" dial, and the information thus established is subsequently recorded on the tape.

In this manner, instructions governing the complete paths of all the tools can be recorded on the tape, together with commands for all auxiliary functions. The work of recording is simple and straightforward, and, it is stated, can be performed by an average person after only a little training.

Hymatic Automatic Billet-handling Equipment for a Forging Furnace



Close-up view of the Hymatic billet-loading equipment provided for a Franklin rotary-hearth furnace which is installed at the works of Smiths Stamping, Ltd., Coventry

The Hymatic Engineering Co., Ltd., Redditch, Worcs, have supplied fully-automatic loading and unloading equipment for use with a Franklin rotary-hearth billet pre-heating furnace which is employed at the works of Smiths Stampings, Ltd., Coventry. This furnace is designed to heat billets for forging, and is of the oil-fired type, operating at 1,300 deg. C. A close-up view of the loading aperture of the furnace is shown in the accompanying figure, where the delivery conveyor for the cold billets, and the Hymatic loading equipment, can also be seen.

To uncover the aperture, the furnace door is lowered pneumatically (to the position shown in the figure) and this arrangement provides unobstructed access for the loading arm. The latter is of the air-operated type, and is carried on a parallelogram-type linkage which is pivoted from a steel structure attached to the roof of the furnace. Operation of the furnace door, the delivery conveyor and the loading arm is interlocked, by means of associated limit switches, and the complete cycle is fully automatic.

Billets are delivered singly, by means of an escapement, to an elevating table, whereby they are raised and positioned between the jaws of the loading arm. The latter are automatically closed, and the elevating table is then lowered and the loading arm is swung downwards, and inwards, to deposit the billet within the furnace. After the arm has withdrawn, the furnace door is automatically raised and a fresh billet is delivered to the elevating table.

The rotary hearth of the furnace is automatically indexed, in synchronism with the movements of the doors and billet-handling equipment. Similar handling equipment to that seen in the figure is provided at the exit door of the furnace, and heated billets are removed and placed on a chute, whence they are delivered to an adjacent forging hammer. The unloading equipment is required to operate in the path of one of the main burners, when a billet is being removed from the furnace, and the jaws of both units are made from haematite heat-resistant cast iron. They will handle billets ranging from 3½ to 6 in. square, in lengths up to 18 in. and with weights from 30 to 104 lb. The through-put of the furnace is 35 cwt. per hour.

Mortimer Machine Tool Demonstration

Demonstrations of some of the machine tools handled in this country by Mortimer Machine Tool Co., Ltd., and Mortimer Engineering Co., Ltd., were staged recently at their showrooms at Mortimer House, Acton Lane, London, N.W.10.

On the latest Swedish-built Köpings type VF 20 vertical milling machine, which was on view, a ½-h.p., d.c.-motor and gearbox are built into the swivel cutter head, to enable steplessly-variable axial feeds from ¾ to 20 in. per min. to be applied to the spindle quill, selection being made by means of a knob on the pendant-type control panel. With this arrangement, a close-up view of which is given in Fig. 1, feed can be applied to the quill when the cutter head is set at any angle up to a maximum of 45 deg. on each side of the vertical position. Any spindle speed within a range from 20 to 1,600 r.p.m., in 24 steps, can be pre-selected, while the machine is in operation if required, by means of a dial mounted on the side of the column. For speed changing, a creep speed, derived from the main 15-h.p. driving motor, is engaged by depressing a push-button on the column to ensure that the gears will be brought smoothly into mesh. The gears required to give the pre-selected spindle speed are then moved into engagement hydraulically, when another push-button is pressed.

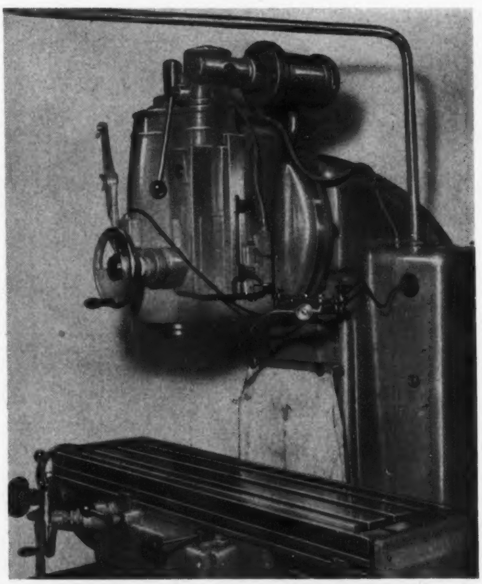


Fig. 1. Steplessly-variable down feeds can be applied to the spindle quill on the Köpings type VF 20 vertical milling machine by a d.c.-motor and gearbox built into the cutter head

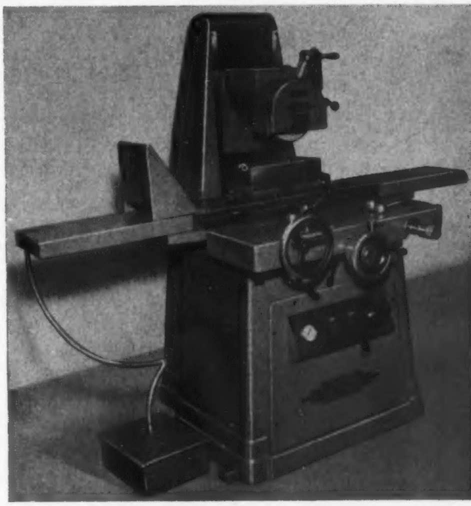


Fig. 2. Jacobsens type SJ 12 hydraulic surface grinding machine

Like the type UF 20 universal machine, which was described in MACHINERY, 95/709—7/10/59, the type VF 20 has a 65- by 14-in. work-table, and traverse movements of 39⅜ in. longitudinally, 13⅜ in. transversely, and 17¾ in. vertically are provided. There are 36 feed rates, which range from ½ to 87 in. per min. in the horizontal directions, and from ¼ to 43½ in. per min. vertically, the drive being taken from a 3½-h.p. motor housed in the knee. Distances from 0 to 21¼ in. are obtainable between the top surface of the table and the nose end of the spindle, which is bored to take an International No. 50 taper shank.

Built by Svend Jacobsens Maskinfabrik A/S., Kastrup, Denmark, the type SJ 12 hydraulic surface grinder illustrated in Fig. 2, has a capacity for workpieces up to 20 in. long by 10 in. wide by 12 in. thick. Alternatively, the machine can be supplied for grinding a maximum length of 24 in.

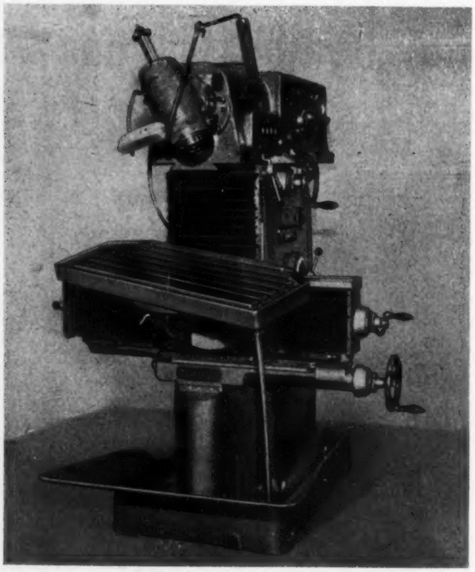


Fig. 3. The latest Maho type MH 800 universal toolroom milling and die-sinking machine

Grinding wheels up to 8 in. diameter by ¾ in. wide may be employed, and the spindle runs in an adjustable 2-row roller bearing at the nose end and a spring-loaded ball bearing at the rear, two adjustable bearings being provided to take end thrust. Drive is transmitted by a flat belt and 2-step pulleys from a 2-h.p. motor, and the spindle speeds obtainable are 2,800 and 3,200 r.p.m. The wheel-head slides on dovetail ways on the column, which are covered by a plastics blind, and rapid power adjustment is provided by a separate 0·3-h.p. motor. Coolant from a reservoir is delivered by gravity through holes in the flange, whence it passes radially through the grinding wheel under centrifugal action, to be applied to the work directly at the point of cutting. A diamond wheel dressing attachment, which has micrometer adjustment, is mounted on the spindle head.

The steplessly-variable table speeds obtainable range from 0 to 55 ft. per min., and a rack and pinion drive, for hand traversing, can be provided if required. Cross feed can be applied to the table saddle by hand, or automatically in increments from 0·002 to $\frac{5}{16}$ in. per stroke. In addition, rapid power traverse can be imparted to the saddle to facilitate setting up. Lubricant is delivered to the table guideways automatically by the hydraulic unit, which is housed in the base and incorporates a gear-type pump, with direct drive from a ¾-h.p. motor.

On the company's type SJ 16 hydraulic surface grinder, the counterbalanced wheel-head slides on roller bearing guideways, and down feed can be applied automatically, for a pre-set distance, in increments from 0·0001 to 0·001 in. per table stroke. Rapid power traverse is provided at the rate of 12 in. per min. for the wheel-head, and 10 ft. per min. for the table saddle in the transverse direction. A maximum distance of 19 in. is obtainable between the centre line of the wheel spindle and the 32- by 10-in. surface of the work-table, which has a maximum travel of 33½ in. The saddle has a cross travel of 12 in., and feeds can be applied in steplessly-variable increments up to ¾ in. per table stroke.

In Fig. 3 is shown the latest Maho (German) type MH 800 universal toolroom milling and die-sinking machine. On this machine, the motor and gearing which drives the horizontal cutter spindle, and the vertical spindle attachment, is housed in the ram-type milling slide. Eighteen speeds are available which range from 32 to 1,320 r.p.m. for the horizontal spindle, and from 45 to 1,900 r.p.m. for the vertical milling attachment. A separate motor of ¾/1 h.p. and gearing, housed in the

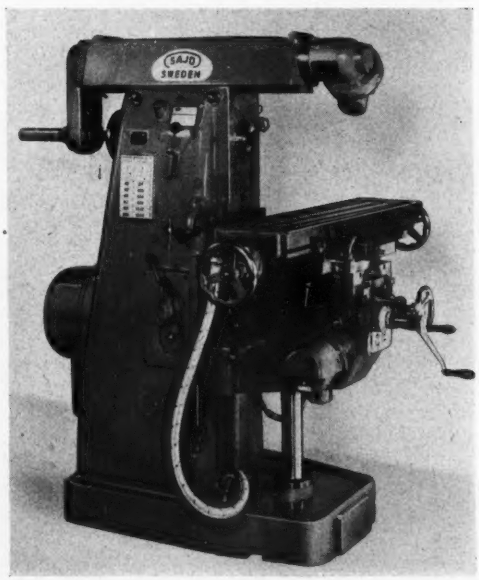


Fig. 4. Drive to the vertical milling attachment on this Sajo type 52 Duo-Mill milling machine is taken from the horizontal cutter spindle through gearing and a shaft inside the overarm

column, provide 18 feeds which range from 5/32 to 7 in. per min. for the milling slide, and from 1/4 to 12 in. per min. for the table slide longitudinally and the saddle vertically. Rapid power traverse is available at the rate of 32 in. per min. for the milling slide, and 54 in. per min. for the table slide and saddle. The milling slide has a cross traverse of 11⅞ in. on guideways on top of the column, and the movements of the table slide and saddle are 19⅝ and 17 in. respectively. When the milling slide has been brought to the extreme position towards the rear of the machine, the distance between the front face of the table slide and the spindle nose is 5 in. The maximum distance that can be obtained between the top surface of the slide and the centre line of the spindle is 23 in. The universal table has a 35½- by 14-in. working surface, and can be swivelled in each direction through a maximum angle of 30 deg. in the horizontal plane, and can be tilted about two horizontal axes at right angles.

The type 52 Duo-Mill horizontal milling machine shown in Fig. 4 is a recent addition to the Swedish-built Sajo range, and is fitted with a special overarm which carries at the outer end a swivel-type vertical milling attachment. Drive for this attachment is taken from a splined shaft at the rear end of the horizontal cutter spindle, through gearing of 1 : 1 ratio, and a shaft housed within the overarm. When horizontal milling is to be carried out, the vertical-spindle attachment, which can be swivelled through a full circle in the horizontal plane, is swung clear, and the drive from the splined shaft is disengaged.

Drive to the horizontal spindle is taken from a 3½-h.p. motor, and there are 12 speeds from 40 to 1,800 r.p.m. The 41⅜- by 9¼-in. work-table has a longitudinal traverse of 27½ in. and a cross movement of 8¼ in., and the vertical travel of the knee is 18¼ in. Twelve feeds, which range from 25/32 to 30 in. per min. in the longitudinal and transverse directions, and from [illegible] to 15 in. per min. vertically, are provided by a ¾-h.p. motor.

The jig borer built by the Linley Brothers Co., Bridgeport, Conn., U.S.A., has recently been the subject of some design improvements, and the latest type is shown in Fig. 5. The 7- by 17½-in. work-table has a longitudinal travel of 10 in., and the cross-slide a movement of 6½ in. They are traversed by ⅝-in. diameter by 10 t.p.i. Acme screws, made from steel and heat treated and precision ground. Accurate settings in both directions are made with the aid of graduations on the 5-in. diameter handwheels, in conjunction with vernier scales. When setting has been completed, the table and cross-slide are secured by pinch-type clamps which are tightened on to metal strips.

Drive is taken from a ½-h.p. motor, through a belt and stepped pulleys which give eight spindle speeds from 275 to 4,250 r.p.m. Alternatively, steplessly-variable spindle speeds from 110 to 3,000 r.p.m., in two ranges, can be provided. Mounted in precision preloaded bearings, the spindle has a taper bore at the nose end to take collets of the nose-clamping type up to ½ in. capacity. The quill has an axial movement of 3 in., and a down feed of approximately 0·001 in. per rev. is provided by a gearbox, which is mounted on the side of the head, and is driven by a belt from the spindle. For accurate adjustment of the spindle quill there is a handwheel which is fitted with a micrometer scale, and a stop is provided to facilitate drilling and boring holes to predetermined depths. The spindle quill and head assembly is counterbalanced by a weight housed in the column, and can be adjusted by a capstan-type handwheel. A maximum distance of 11½ in. is obtainable between the top surface of the table and the spindle nose. The centre line of the spindle is 5¾ in. from the column ways.

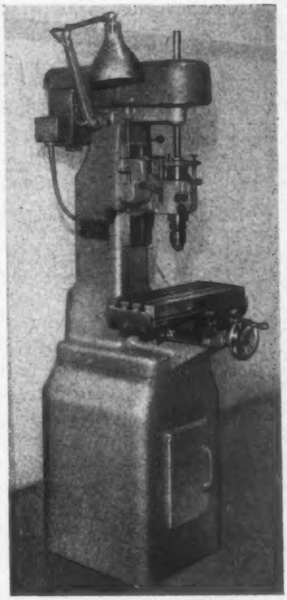


Fig. 5. The latest Linley jig borer

TEXLITE PACK-CUSHIONING MATERIAL, which has been introduced by the Hairlok Co., Ltd., Magna Works, Bedford, is of crimped rubberized hair composition and is made by a special process which is stated to ensure exceptional resilience and resistance to stratification. It is claimed that the material offers particular advantages for the packing of electronic and other delicate instruments, control equipment, fragile electrical apparatus, and machine parts. Texlite can be supplied in standard densities of 4 lb. and 6 lb. per cu. ft. and in thicknesses of 1, 1½, and 2 in. in sheet form, or cut and fabricated as required.

K2

NEWS OF THE INDUSTRY

London and the South

BLACKHAWK, LTD., 12-16 Brunel Road, Acton, London, W.3, can supply a wide range of portable hydraulic tools which have many applications in maintenance workshops and factories and on outside sites. Hydraulic jacks are available in various sizes from 1½ to 100 tons rating, with self-contained pumps, and those of 30, 50, and 100 tons capacity may be remotely controlled, and operated in the inverted position if required.

Blackhawk Holl-O-Ram units are now made with 12-, 20-, 30-, and 60-ton ratings and are provided with hollow plungers which will accommodate various attachments—for example, drawbars which enable the thrust to be directly converted to a pulling action. A typical set-up, for removing a pulley and key from the crankshaft of a machine tool, is shown in the accompanying illustration. The Holl-O-Ram at *A* is connected by a pressure hose to a hand-operated hydraulic pump (not shown). A threaded rod *B*, screwed into a bush in the hollow plunger, transfers pressure to the Holl-O-Ram body, which, in turn, exerts a force against the cross-head of the pulley-drawer *C*. Variations of this set-up are employed for removing engines from airframes where manœuvrability is restricted.

A Blackhawk Holl-O-Ram hydraulic ram unit and a pulling attachment are here being employed for removing a pulley and key from a shaft

The wide variety of tools comprising the Porto-Power range of hydraulically-operated equipment includes types which are finding increasing application, for instance, for straightening shafting; supporting cross-heads of presses when adjustments are being made; levelling machine tools, with the aid of a toe-lift attachment; dislodging jammed tool-holders; removing taper pins; and spreading punch and die members.

ROCKWELL MACHINE TOOL CO., LTD., Welsh Harp, Edgware Road, London, N.W.2, are experiencing a steady demand for Matrix thread grinding machines and British-built U.S. Multi-slide machines from firms at home and overseas. Almost half the output of the latter machines is exported, and it may be noted that they—also the Matrix range of machine tools—are distributed throughout Germany by Matrix G.m.b.H., Langen, near Frankfurt. Several German firms, we are informed, have placed repeat orders for Multi-slide machines. A good demand is reported for Thompson plain surface grinding machines with tables up to 96 in. long, and for Truforming machines, which provide for accurate contour grinding, for example, of parts for aero engines, computers and motor vehicles, also thread chaser dies. Some machines in this range are being built for export.

E. P. BARRUS, LTD., 12-16 Brunel Road, London, W.3, are experiencing a steady call for Devcon products which include a variety of air-hardening compounds of metal powders and plastics for which there are many applications in industry. Devcon

plastic steel, for example, is stated to acquire an ultimate tensile strength of 10,000 lb. per sq. in. when it has hardened, and various machining operations, including drilling, tapping, and grinding, can be carried out. One of the principal uses of this material is for making jigs, fixtures and other work holding devices. It has also been employed for reclamation work, for example, for the repair of a cracked cylinder of a 3,000-ton hydraulic press, and for filling holes drilled in error in machined parts.

It may be noted that Devcon F putty has been introduced for filling holes in aluminium and steel castings, also wooden patterns. Devcon WR, which is another product, is stated to possess self-lubricating properties and to be wear-resistant.

SMART & BROWN (MACHINE TOOLS), LTD., 25 Manchester Square, London, W.1, inform us that they are still very busy on account of the steadily increasing demand from the home and export markets for their range of machine tools. Pultra lathes are selling well in Britain and various overseas markets including India. The range of Smart & Brown lathes is being "streamlined" in order to concentrate the company's resources for machine tool building on a narrower field. As a result of this change of policy the building of the 4½-in. centre height precision lathe and the type M air-operated automatic lathe will shortly cease, but the output of the remaining types will be increased. The 1-ton and 2-ton toggle action bench presses are still very popular, and there is continuing interest in the S. & B. portable screwing machine, of which a number has recently been sold.

PLATE WORKING MACHINERY LICENCEES, LTD., 42 Broadway, London, S.W.1, are busy with enquiries for equipment for shearing plate and bending pipes. This company has supplied a number of French-built Corpet Louvet hydraulically-operated shears for producing square, bevelled, or combined square and bevelled edges on plates for shipbuilding and other applications. The three standard machines in the range have capacities for plate up to 10 ft. wide with maximum thicknesses of ⅝ in., ¾ in., and 1 in. A feature common to all machines of this type is the dual blade assembly which permits bevel or square shearing, or both, at one set-up of the plate. The tube bending machines which this company handles are built in France by Ateliers Coupé Hugot, a cold-rolling technique being employed for producing bends in thin- or thick-walled tubes without the aid of formers. It is claimed that when tubes are bent by this process, which is the subject of Wilman patents, there is an increase in tensile strength, and the original circular bore section is retained.

LITTONS MACHINE TOOL CO., LTD., 372-378 Old Street, E.C.1, and 42 North Road, Islington, N.7, report that the general demand for rebuilt machine tools from the home and export markets is well maintained. It may be noted that a Swift centre lathe of 36-in. swing and a capacity of 18 ft. between centres has just been despatched to a customer in South Africa. A Lang lathe of comparable size was recently sold to a firm in South America. The company's slideway grinding facilities at the North Road Works, which have been gradually increased during recent years, are kept well occupied, and contract work is undertaken for customers in many parts of the country.

THE LAPOINTE MACHINE TOOL CO., LTD., Otterspool, Watford By-Pass, Watford, Herts., are busy with the building of a variety of broaching machines for different applications. An interesting machine has been designed and built for surface broaching by a continuous method. Components are held in fixtures forming part of an endless linkage

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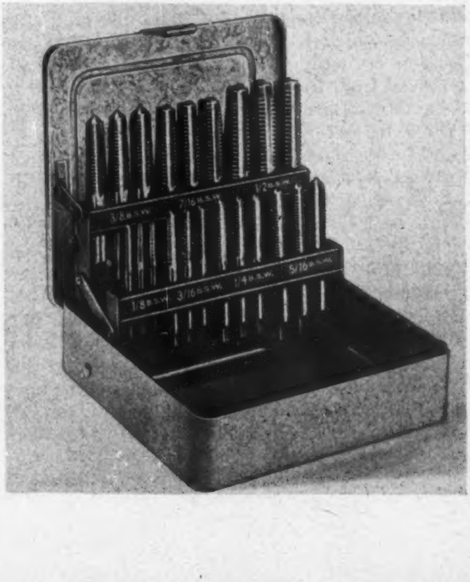
The container for taps, here illustrated, has been introduced by Easterbrook, Allcard & Co., Ltd., Penistone Road, Sheffield, 6. When the metal container, which measures 5 in. square by 1¼ in. deep, is opened, racks containing the taps swing to the vertical position. There are seven sets of Whitworth taps, of sizes from ⅛ to ½ in., and the size of each set is marked to permit rapid selection. Apart from the convenience thus afforded, the taps are effectively protected from damage when not in use



passing through a tunnel lined with broaches, which impart the desired profile to the surface of each part. Another machine recently built is operated hydraulically and is intended for vertical surface broaching operations, at speeds up to 180 ft. per minute. Many of the machines are supplied with work holding fixtures.

W. E. Sykes, Ltd., Staines, Middlesex, are busy with the production of a variety of machine tools for gear production, including the V 10 B vertical gear generator which has superseded the V 10 A machine. Semi-automatic versions of the V 10 B can be supplied, and may be adapted for inclusion in production lines, if required.

Sykomatic vertical gear generating machines, which are variants of the V 10 B, are widely employed for the quantity production of internal and external gears. This machine is equipped with an indexing table whereby blanks are presented successively to the cutter on an automatic cycle. Certain components, usually in the form of plain discs, can be fed to the cutting station from a hopper, and one operator can tend several machines of this type.

Demand for Sykes gear machines from the home and export markets, which include the U.S.A. and Japan, are maintained at a satisfactory level.

Industrial Impregnations, Ltd., Willow Road, Poyle Trading Estate, Colnbrook, Bucks., are reclaiming large numbers of castings including machine tool beds, hydraulic cylinders, valve bodies, water turbine casings, cylinder blocks, and rollers, for example, which are defective owing to porosity and must be made pressure tight before being accepted for service. Small castings are normally cleaned, dehydrated, and placed in an autoclave, which is then evacuated prior to the admission of impregnating compound. The work is removed from the autoclave, cured and tested to specified pressures, which are sometimes as high as 6,000 lb. per sq. in. Larger castings can be treated in the shops, or on site if more convenient, by a localized evacuation and impregnation technique in which the company specializes. During recent years, a method of impregnating a wide variety of parts produced from compacted and sintered metallic powders has been developed by the company.

After treatment, it is stated, such parts are suitable for plating. Polyester resins are now being employed for impregnation, and it is reported that good results are also being obtained with epoxy resins. Work is undertaken for nuclear energy applications, and to A.R.B. and A.I.D. specifications.

F. W. Herridge.

Yorkshire

Abrafract, Ltd., Beulah Road, Owlerton, Sheffield, 6, inform us that as a result of progressive expansion of their sales and manufacturing capacity, they now employ more than 200 people in two factories devoted to the production of grinding wheels. The company recently received an order from Australia for 60-in. diameter wheels for grinding saw blanks. These wheels are the largest that they have yet made, and the cost of each was more than £250.

For the production of the wheels, 60 mesh aluminium oxide grit was bonded with sodium silicate, and approximately 1 ton of the mixture was required for each wheel. On account of the size, each wheel was baked separately, and the cycle, which occupied six days, was carefully controlled to avoid cracking. Considerable care was also necessary in handling the baked wheels and machining them to size, to ensure that they were not damaged. Before despatch, each wheel was tested at a speed 50 per cent higher than that at which it will operate.

G. ELtherington & Co., Ltd., Burdwell Works, Brockholes, near Huddersfield, inform us that they were recently awarded the contract for supplying, over the next three years, machine tools and equipment to the total value of some £500,000, for a complete new factory in India. This factory will undertake the manufacture of sugar crushing plant, rubber and paper processing plant, and turbines. "Used" machines, built during the period from 1952 to 1960, will be supplied for the most part.

The first consignment of this equipment is at present being packed for shipment. It is valued at approximately £100,000, and comprises single- and double-head type Omerod shaping machines; five Minganti 2.A. turret lathes; a Butler 30-in. puncher-slotter equipped for cutting gears up to a maximum diameter of 15 ft.; four 6-ft. capacity horizontal milling machines; radial drilling machines of 6- and 10-ft. radius; vertical borers; balancing machinery; gear cutting machines and auxiliary equipment; horizontal type boring machines; a number of lathes, including a Craven machine which admits 36 ft. between centres; and roll grinding machines and equipment.

Yorkshire Precision Gauges, Ltd., Hatfield, near Doncaster, report a strong demand for their range of gauges which includes plain "go" and "not-go" plug and snap gauges, and adjustable caliper gauges with capacities from 0 to 36 in. We are informed that recently introduced length gauges, which are made to the American com-

mercial specification No. C.S.8-51 in capacities from 0 to 48 in. have been very well received, and that the volume of orders for these gauges is steadily increasing. New plant recently installed in the works includes a Colchester lathe and a Myford grinding machine.

WM. HARDILL SONS & CO., LTD., Netherfield Ironworks, Cleckheaton, report a steady demand for all the woodworking machines in their range, which include saw benches, band saws, and planing machines. There has been an increasing request in recent months for conveyor pulleys and drums of fabricated steel construction, cast iron, and wrought iron, and orders in hand at present cover drums up to 30 in. diameter by 48 in. wide. The foundry is maintaining a high rate of production of floor and machine moulded castings with individual weights ranging up to 1 ton. In particular, there is a keen demand for castings from various machine tool builders in the district.

THE CRESCENT ENGINEERING CO., LTD., Hightown, Liversedge, report full capacity operation on sub-contract machining of a variety of work, including components for hydraulic equipment. A number of contracts is at present in hand for the production of special machinery for wire drawing, rope making, and box making. We are informed that recent orders received for Finny tap sharpening machines have included one for export to Brazil, and others which are destined for use in the motor car industry.

TOM SENIOR (LIVERSEDGE), LTD., Atlas Works, Liversedge, are busy with the production of their range of milling machines and auxiliary equipment, the demand for which, it is stated, has been steadily increasing since the Machine Tool Exhibition was held at Olympia. Export orders have been received from a number of countries. A works extension, which has recently been completed, is to be used as a machine shop to enable the company to meet the rising demand.

T. S. HARRISON & SONS, LTD., Union Street, Heckmondwike, are receiving increasing numbers of orders, from both the home trade and the export markets, for their range of machines, which includes profiling lathes, tool and cutter grinders, and wood-turning lathes. We are informed that the recently introduced milling machine has been very well received, and has been the subject of numerous enquiries and orders from the U.S.A.

As part of a major expansion scheme, an extension to the works of some 20,000 sq. ft. is now under construction. This scheme, it may be mentioned, also covers plant, and among new machines already installed may be mentioned a Minganti programme-controlled turret lathe and a Snow form grinder.

We are informed that the associate firm, Denfords Engineering Co., Ltd., are well placed for orders for their range of machines and equipment for educational purposes. A large proportion of current commitments is accounted for by export orders from various countries.

R.J.H. TOOL & EQUIPMENT CO., LTD., Heckmondwike, report a continued increase in the sales of their range of grinding machines. Among machines on order there is a number for export to Canada and the Far East.

J. BLAKEBOROUGH & SONS, LTD., Birds Royd, Brighouse, report that their output of valves has remained at a high level throughout the past year. The production programme has included many types and sizes of fluid control valves, which are among the principal products of the company. Recent developments have included the introduction of rubber seated butterfly valves for tight shut-off, and gate valves with resilient seatings for oil tanker and other applications.

Contracts are at present in hand for the supply of butterfly valves of 78-in. diameter port capacity for Dungeness power station, 42-in. and 66-in. valves for the Trawsfynydd power station, and a number of 66-in. valves for Tokai Mura in Japan. We may also note that an order for 90-in. bore motor-operated gate valves, for the Drakelow power station, has recently been received. All sections of the foundry at the Brighouse works are fully employed, including that concerned with Meehanite, on castings for the firm's products.

The Greetland works are maintaining a high rate of output of pneumatically operated, diaphragm-controlled, valves, which are made under licence from the U.S.A.

DENFORD SMALL TOOLS (BRIGHOUSE), LTD., Victoria Works, Birds Royd, Brighouse, report an increasing call for their range of Viceroy machine tools and equipment, from educational authorities both at home and abroad, and we are informed that an order has recently been received from Egypt. A Quick-Lite forge and brazing hearth has now been added to the range of products. A heavy demand is also being experienced for the range of tool holders, and it may be noted that the U.S.A. is prominent in the list of countries to which these items are now exported.

The Futurmill planer/miller conversion unit which this company builds under licence from Futurmill Conversions, U.S.A., is in good demand from the heavy engineering industry. A right-angled nose attachment and a fine feed attach-

ment have recently been developed for this unit.

THE YORKSHIRE DIE-CASTING CO., LTD., Ashday Works, Brighouse Road, Elland, makers of both pressure and gravity die castings, report increasing calls on their services from a growing number of manufacturers concerned with a wide variety of products. The company is at present equipped to handle zinc-base alloy pressure die castings up to 5 lb. weight, and aluminium alloy gravity die castings up to 12 lb. Zinc-base die castings made by the company conform to the requirements of the British Standards Institution.

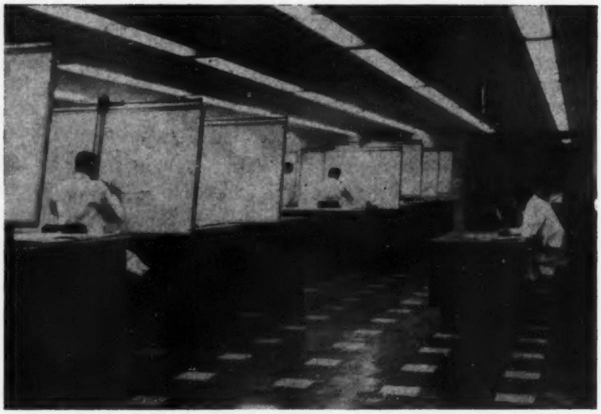
JAMES RESIDE, LTD., Brighouse, inform us that their group of companies, which also includes Reside (Pressings), Ltd., Rastrick Engineering Co., Ltd., and Surgicon, Ltd., is experiencing an increasing demand for the products of all departments. These products include foundry cupolas, ladles, mould conveyors, sand conditioning and handling equipment, and elevators, which are individually designed to suit particular applications. In addition, mention may be made of gearboxes; fabricated structures such as machine bases; auxiliary equipment for steel-works; heat exchangers; welded tanks and vessels; and bulk handling plant. Press-work on a contract basis is undertaken, for example, for makers of electronic and electrical equipment, machine tool builders, and light and heavy vehicle manufacturers, the works being equipped with a range of presses up to 300 tons capacity.

R. SUTCLIFFE.

Landis Lund Drawing Offices

New premises to house the production drawing office, design department and print room have recently been completed at the works of Landis Lund, Ltd., Cross Hills, Nr. Keighley, Yorks. The total area is approximately 3,500 sq. ft., and lighting is provided by twin-tube fluorescent fixtures with diffusers, which provide an intensity of 90 ft.-candles without glare. Heating is by low pressure steam convectors with automatic local temperature control, and provision is made for four changes of air per hour. The ceiling is of suspended white acoustic tiles with thermal insulating properties.

In the production drawing office, a view of which is shown in the figure, there are 20 boards with built-in counterweights, mounted on special tables of Landis Lund design. These boards have vertical adjustment and the drafting machines are also of special design.



A view in the new drawing office at the works of Landis Lund, Ltd.

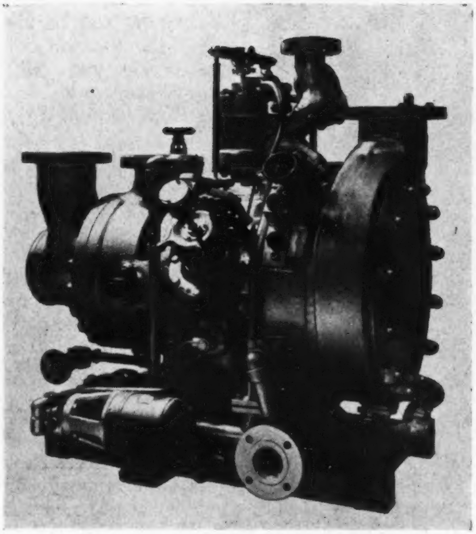
The new design department has four small drawing boards and two large boards with power operated vertical adjustment under finger tip control.

A continuously operating printing machine is provided in the print room and there are steel cabinets which have a capacity for 33,000 original drawings.

Pulsometer Pacific Steam Turbopump

Known as the "Pulsometer Pacific Steam Turbopump," a unit now being produced under licence by Pulsometer Engineering Co., Ltd., Oxford Road, Reading, Berks., is intended primarily for feeding water to marine boilers. It incorporates a steam turbine and a single-stage centrifugal pump, the motors of which are mounted on a common shaft, and is capable of delivering up to 750 gal. per min. against pressures up to 1,100 lb. per sq. in. (gauge). The floor space required, and the weight, it is claimed, are approximately 50 and 25 per cent. less, respectively, than for multi-stage units of similar capacity.

Designed for operation at speeds between 5,000 and 10,000 r.p.m., the unit is controlled by an adjustable, centrifugal-type governor. A separate arrangement cuts off the steam supply if the governor should fail, or if the speed rises by 15 per cent, and over-speeding, such as may result from



The Pacific Steam Turbopump for boiler feed, which is being made under licence by Pulsometer Engineering Co., Ltd.

loss of suction, normally causes no damage. During operation, the main shaft of the unit is supported hydro-dynamically in the bearings, and pressure oil for the lubrication system is supplied by a double-helical gear pump, which is driven from the governor shaft. A separate, automatically-operated, motor-driven gear pump is provided for use during the starting-up and shutting down periods, or in emergencies.

Demand for Engineering Technicians

The Ministry of Labour has recently published an analysis of the results of a questionnaire that was sent to 400 companies in the engineering and chemical industries during the early part of 1960, to determine the estimated requirements for technicians during the next two years. It is forecast that in most branches of these industries, the total demand in the next two years will be double the number of existing vacancies, and that to satisfy this demand an increase of 16 per cent in the number of technicians employed will be necessary. In the metal manufacturing field, it is estimated that the total number of vacancies for technicians will be four times the present number, requiring an increase of 20 per cent in the number of technicians employed. In the shipbuilding industry, on the other hand, many firms are doubtful whether any more technicians will be needed during the next two years.

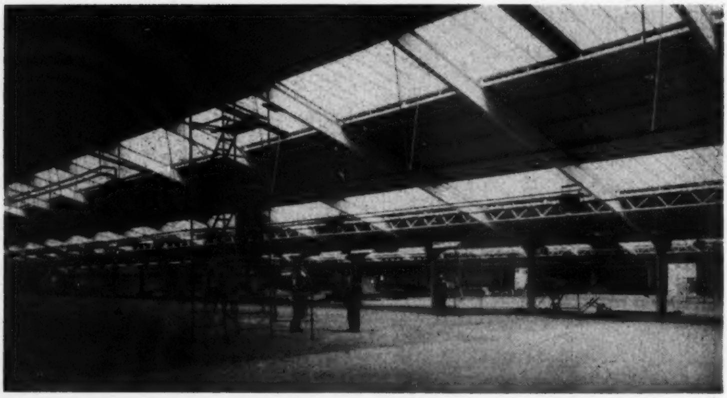
The object of the survey was to gain information concerning the proportion of technicians to other workers, the proportions engaged on different types of work, the qualifications held, and present and future demand. Companies to whom the questionnaires were sent account for about 22 per cent of the total labour force in the engineering and chemical industries. On average, in these companies, there were four technicians to every qualified scientist or engineer; in the chemical and oil refining industries, the proportion was about 1·5 to 1, and in the engineering industry, more than 5 to 1. Only 4½ per cent of the technicians were women. There was considerable variation in the ratio of technicians to total number of employees, not only from one branch of industry to another, but also between different firms in the same branch. The highest proportion was 11·6 per cent in the electrical and electronics branch, and the lowest in the miscellaneous metal goods, metal manufacturing, and shipbuilding groups, which had 4·1, 4·4 and 5·5 per cent respectively.

Answers to the questionnaire indicate that about one-third of all technicians were engaged in design and drawing office work, which accounted for 41 per cent of the total demand. The next largest requirements were for laboratory technicians, and those for testing, inspection and analysis. It is estimated that the overall shortage of technicians is now 7·7 per cent, whereas the shortage of qualified scientists and engineers in the industries under review was 9·6 per cent in 1959. Nearly 14 per cent of technicians held Higher National Diplomas, Higher National Certificates or were members of a professional institution, and nearly 17 per cent held Ordinary National Certificates or City and Guilds Final or Intermediate Certificates.

As there is no accepted definition of the term "technician," employers were supplied with a memorandum in which it was defined in a wide sense, and guidance was given concerning the categories to be included. Detailed results of the survey were published in the *Ministry of Labour Gazette* for December.

Stein Atkinson Vickers Hydraulics

It is announced that negotiations are being concluded between Vickers, Inc., Detroit, and Stein & Atkinson, Ltd., whereby the former company will acquire the interest of the latter, in Stein Atkinson Vickers Hydraulics, Ltd., 197 Knightsbridge, London, S.W.7. There will be no change



A view showing part of the new factory building of Stein Atkinson Vickers Hydraulics, near Havant, Hampshire

in the existing British management, it is stated.

Owing to the increasing demand for Vickers-Detroit hydraulic equipment, a new factory has been built on a 12-acre site near Havant, Hampshire. The accompanying illustration shows part of two large bays which will house the machine and assembly shops.

M.T.T.A. Education Officer

In a statement issued at the time of the publication of the Mitchell Report (see MACHINERY, 97/1204—23/11/60) the Machine Tool Trades Association announced that an education officer had already been appointed, with the widest possible brief. The post is held by Mr. G. L. H. Bird, B.Sc. (Eng.), M.I.Mech.E., who took up his duties on January 2 and will shortly begin a tour of the industry in order to become fully acquainted with the nature and magnitude of his task.

Mr. G. L. H. Bird

Mr. Bird has been concerned with technological education since 1947 and latterly was head of the Department of Mechanical Engineering at the Borough Polytechnic, London, S.E.1. Activities of this Department, it may be noted, include production engineering. From 1947 to 1956 he was on the staff of the National College for Heating, Ventilating, Refrigeration, and Fan Engineering. Prior to 1947, apart from the war years, Mr. Bird was engaged as a mechanical engineer in industry.

It is expected that with the assistance of Mr. Bird, solutions will be found for the problems posed by the rapid advances in the specialized technology of machine tools.

Recalling that in 1959 a scheme was introduced whereby 10 scholarships are granted annually for a 2-year post-graduate course at Manchester University, the Association point out that: "With the anticipated extension of activity of this kind, the numbers of technologically qualified staff in the industry should show the needed steady increase, and it should become evident that the industry offers a most promising future for young men embarking upon a career in engineering."

Overseas Trade

(*Continued from page* 59)

been levelled from time to time against British firms in some sections of this broad field, it is encouraging to know that they continue to make progress, often in the face of intense competition. What is perhaps more remarkable is the fact that for the period in question the U.S.A. provided a market for our machinery (£44·4 million) second only to Australia (£55 million), and that among the 10 largest outlets were also included Western Germany (£28·5 million), France (£28·5 million), Italy (£22·2 million), Netherlands (£21·5 million), and Sweden (£19·9 million).

Machine Tool Orders

Net new orders for machine tools in October were valued at £11,734,000, of which £2,382,000 was for export. Deliveries during the month amounted to £8,069,000, including £1,996,000 for export. Owing to the continued high rate of order booking, the value of orders in hand at the end of the month rose to £102,342,000, and included £23,097,000 for export. This figure last exceeded £100,000,000 at the end of November, 1956.

Industrial Notes

AN AUCTION SALE OF MACHINE TOOLS and miscellaneous stores will be held on January 19 at the W.D. Storage Depot, Rotherwas, Hereford. The auctioneers will be Russell, Baldwin & Bright, Ltd. (Dept. N), 20 King Street, Hereford.

M. HALES & CO., LTD., have moved to new premises at 73 Devon Street, Saltley, Birmingham, 7 (telephone, Aston Cross 2993). Here the company has facilities for the demonstration of machine tools under power, and there is a large car park which is shared with the parent company, Stanley Howard, Ltd.

THE UNITED STEEL COMPANIES, LTD., The Mount, Broomhill, Sheffield, 10, report that in 1960 steel output by the constituent firms amounted to 3,280,143 tons. This was the first occasion on which the total exceeded 3 million ingot tons.

Pig iron production, at 2,003,413 tons, was also at a record level for the companies.

TOOL TREATMENTS (CHEMICALS), LTD., Colliery Road, Birmingham Road, West Bromwich, have concluded a trading agreement with the CHEMICAL CORPORATION, Massachusetts, U.S.A. Under this agreement, the Blakodize process will be marketed under licence in America by the Chemical Corporation, and the Luster-on products will be marketed in this country by Tool Treatments (Chemicals), Ltd.

HOOVER, LTD., have recently installed two electronic computers supplied by International Computers & Tabulators, Ltd., in their Perivale, Middlesex, office headquarters. These machines are being used for the calculating and data processing of payrolls, cost analysis, accounting, budget control, and production of sales statistics. They may later be applied to production control.

THE FIRST NATIONAL DRAWING OFFICE EQUIPMENT AND MATERIALS EXHIBITION in the United Kingdom will be held in the Royal Horticultural Society's New Hall, Westminster, from June 5-8. Both British and imported equipment will be on view, and it is stated that nearly half of the available stand space has already been booked. Further particulars can be obtained from the organizers, UTP Exhibitions, Ltd., 9 Gough Square, Fleet Street, London, E.C.4.

ELCONTROL, LTD., Wilbury Way, Hitchin, Herts., have ssued technical data sheet F.P. which outlines the range of Elcontrol units now available either with certified intrinsically safe circuitry or in certified flame-proof enclosures, for use in or near hazardous areas. Another data sheet (W.S.) is concerned with a fully automatic water sampling unit which is now going into production. This unit is being manufactured under licence from the N.R.D.C.

HENRY BEAKBANE (FORTOX), LTD., The Tannery, Stourport, Worcs., have concluded arrangements with Gebr. Hennig o. H.G. Co., Munich, whereby they will supply Hennig sheet metal telescopic guards and corrugated covers for machine tools. They will also undertake servicing and repair of such covers fitted to existing machine tools. The British company's impending move to a newly erected factory at Kidderminster will facilitate such servicing work. In the meanwhile enquires should be sent to the above address.

FERRANTI, LTD., Hollinwood, have obtained a contract, in the face of strong foreign competition, from the Electricity Commission of New South Wales, valued at more than £400,000, for the supply and installation of three 240 MVA, 16·5/348 kV., 3-phase generator transformers. The units, which, it is stated, will be the largest with aluminium tanks yet built in the United Kingdom, are to be installed at Vales Point Power Station, 70 miles north of Sydney. Aluminium tanks will keep the weight of each unit down to 147 tons for transport purposes.

ENGINEERS' GUILD, LTD., 201 High Holborn, London, W.C.1, will hold a one-day conference at the Connaught Rooms, Great Queen Street, London, W.C.2, on March 22. This conference will be concerned with "The Professional Engineer—His Employment and Development," and the principal speakers will include Viscount Chandos, chairman of A.E.I. It is intended for managers, personnel officers, and professional engineers, and copies of the programme can be obtained from the secretary, at the above address.

VACUUM RESEARCH (CAMBRIDGE), LTD., Quayside, Bridge Street, Cambridge, have received an order from the Admiralty, valued at more than £7,500, for a high vacuum brazing furnace. Arranged for electric resistance heating, this furnace will have a hot zone with dimensions of 2 ft. by 1 ft. square, in which temperatures up to 1,300 deg. C. can be maintained. Provision will be made for evacuation to less than 10^{-4} mm. of mercury, and there will be a shielded window to enable the operator to view work within the chamber.

MORRIS MOTORS, LTD., Cowley, Oxford, have announced the completion of the one millionth Morris Minor car. It is stated that this is the first occasion in the history of the British motor car industry that the output of one type of car has reached this total. The first Morris Minor came off the production line in October, 1948, and in the next four years the number completed was 171,000. In 1952 the Series II was introduced, and by 1956, 322,000 cars of this model had been built. The latter year saw the introduction of the Minor 1,000, the production of which now exceeds 500,000.

APWAR, LTD., 37 Sheen Road, Richmond, Surrey, have introduced a range of plain plug and reversible pin gauges of high quality as regards size, finish and hardness. It is stated, for example, that surface finish is within 1 micro-inch. The gauges are made, in taper-lock, tri-lock, and reversible pin designs, and handles are of aluminium alloy with an oxidized blue finish as standard. Handles finished in black or other colours can, however, be supplied if

required. Plain plug gauges are available, to order, with hard chromium finish, made from Nitralloy, or of a piloted form.

Charles Churchill & Co., Ltd., South Yardley, Birmingham, have asked us to point out that whereas they have a sales arrangement with The Churchill Machine Tool Co., Ltd., Broadheath, Manchester, neither company has any financial interest in the other.

Leeds & Northrup, Ltd., is the new title which has been adopted by the company formerly known as Integra, Leeds & Northrup, Ltd., following the acquisition by the Leeds & Northrup Co., Philadelphia, of all shares that they did not previously own. The address of the company is Edgbaston House, 183 Broad Street, Birmingham, 15. It is the intention of the parent company to supply substantial additional capital to provide for the building of new works and offices, and to enable Leeds & Northrup, Ltd., to embark on a programme of development and expansion of plant and equipment.

Mortimer Machine Tool Co., Ltd., Mortimer House, Acton Lane, London, N.W.10, have been appointed sole agents in this country for Buhr Machine Tool Co., Ann Arbor, Michigan, U.S.A. The latter company builds a range of special purpose multi-operation machines which are marketed under the name Economatic and include centre column, shuttle, dial index, trunnion and transfer types. These machines incorporate components based on the "special machine tool standards" in the establishment of which the company played a leading part. A transfer machine supplied for operations on Rambler cylinder heads is 220 ft. long and weighs 250 tons. A total of 323 operations is performed at 58 stations.

Charles Churchill Acquire Denhams

Charles Churchill & Co., Ltd., Coventry Road, South Yardley, Birmingham, inform us that Denham's Engineering Co., Ltd., is now incorporated in the Charles Churchill Group of companies. The production of general purpose lathes will be continued, but the manufacturing capacity will be expanded to enable other machines within the range handled by the group to be built. Mr. Roy S. Denham, the chairman and managing director, is retiring, but all other members of the management team are remaining with the company, which will continue to function as an autonomous unit and will for the present maintain independent selling arrangements.

It is pointed out in this connection that the recent acquisition of Newcast Foundries by the Charles Churchill Group has ensured supplies of castings of the necessary quality to enable output of existing machines to be maintained and further developments to be undertaken.

Swisstool Agencies

In Machinery, 97/1433—21/12/60 it was stated that Dowding & Doll, Ltd., had been appointed sole agents for Swisstool, Ltd., Zurich. It should be explained that this agency arrangement covers sheet metal notching machines and Benninger universal thread milling machines.

As regards other machine tools built or factored by Swisstool, Ltd., the position is as follows:

Haesler Sales, Division of Adam Engineering Co., Ltd., 4 Grange Street, St. Albans, Herts., are sole agents for Landert vertical-spindle die and surface grinders and rotary-table surface grinders; Sim valve cone grinders and diamond piston-turning lathes; nut tappers; and hydraulic shaft straightening presses.

Lancing Machine Tools, Ltd., Commerce Way, Lancing, Sussex, are sole agents for Original Schaerer vertical shapers; plate edge planing machines; and circular bending machines.

None of these agency arrangements, it should be pointed out, covers Scotland, where John S. Young & Co., Ltd., Burnfield Road, Giffnock, Glasgow, are sole agents for all Swisstool products and factored machines.

New Year Honours

The recently published New Year Honours List includes he following:—

Barons

Fleck, Sir Alexander, chairman, Advisory Council on Research and Development, Ministry of Power, and of the Nuclear Safety Advisory Committee.

Knights Bachelor

Beharrell, G. E., chairman, Dunlop Rubber Co., Ltd.

Dannatt, C., vice-chairman, Associated Electrical Industries, Ltd.

G.B.E.

Hunter, Sir Ellis, chairman and managing director, Dorman, Long & Co., Ltd.

C.B.E.

Gardiner, G. C. J., technical director, de Havilland Aircraft Co., Ltd.

McGinnety, F. E., director-general of inspection, Ministry of Aviation.

Pheazey, J. R., vice-chairman and joint general manager, Standard Telephones & Cables, Ltd.

Rubbra, A. A., technical director, Rolls-Royce, Ltd.

Scott, J. B., sales director, Crompton Parkinson, Ltd.

Thacker, C., managing director, Ford Motor Co., Ltd.

Watts, G. E., principal, Brighton Technical College.

Woods, H., H.M. deputy chief inspector of factories, Ministry of Labour.

Young, A. J., managing director, English Electric Valve Co., Ltd.

O.B.E.

Emerson, S. J., H.M. senior electrical inspector of factories, Ministry of Labour.

Gale, F. W. J., managing director, S. G. Brown, Ltd., Watford.

Harvey, W. R., manager, marine department, Babcock & Wilcox, Ltd.

Newman, E. G. V., principal scientific officer, Royal Mint.

Wolridge, J. C., for services to North Gloucestershire Productivity Association.

Woodhead, F. chairman and managing director, Toledo Woodhead Springs, Ltd.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended Oct. 31, 1960	Ten months ended October 31	
		1959	1960
	Value £	Value £	Value £
New, complete—			
Bar and chucking automatics	38,499	624,161	624,965
Boring machines:			
Vertical	48,802	358,467	334,087
Other	204,012	704,849	1,138,444
Drilling machines	100,179	.812,073	1,042,436
Gear-cutting machines	20,782	563,714	811,393
Grinding, lapping and honing machines	279,548	2,173,863	2,228,123
Lathes:			
Capstan and turret	254,610	1,418,806	1,807,938
Other	287,608	2,838,128	2,967,594
Milling machines	127,849	1,254,049	1,676,074
Planing machines	—	171,004	148,379
Presses:			
Hydraulic	309,798	927,859	1,012,062
Other	97,560	546,336	1,988,299
Punching and shearing machines	29,977	210,309	468,859
Other plate and sheet metal-working machines, including straightening rolls	27,749	368,620	485,699
Screwing and threading machines	49,192	550,987	644,621
Shaping and slotting machines	51,258	339,363	355,841
All other machines	189,298	1,972,332	2,299,201
Used, complete	60,021	1,094,754	933,998
Parts	251,538	1,957,783	2,507,492
Total	2,428,280	18,987,457	23,475,505
Destination			
Union of South Africa	126,087	906,314	1,064,512
India	551,352	2,531,806	3,086,496
Australia	344,661	2,709,351	4,952,377
New Zealand	55,443	327,116	362,794
Canada	83,709	950,687	1,078,131
Other Commonwealth countries	93,264	1,305,168	1,231,613
Soviet Union	—	47,246	291,905
Sweden	53,013	232,283	621,559
Western Germany	125,206	540,410	961,821
Netherlands	115,945	322,731	558,708
France	132,068	2,366,107	1,352,251
Spain	9,256	287,179	354,262
Italy	40,431	376,995	627,572
United States of America	164,709	1,780,392	1,989,730
Other foreign countries	533,136	4,303,672	4,941,774

IMPORTS OF MACHINE TOOLS

New, complete—			
Bar and chucking automatics	58,057	341,078	476,226
Boring machines	163,732	892,612	1,147,219
Drilling machines	21,966	156,237	289,214
Gear-cutting machines	77,384	705,532	573,749
Grinding, lapping and honing machines	308,593	1,733,453	3,498,407
Lathes	235,885	1,341,225	1,799,014
Milling machines	386,364	1,893,259	2,703,843
Planing, shaping and slotting machines	63,660	213,024	336,577
Presses	85,728	808,313	1,225,115
All other machines	322,504	2,728,199	3,153,865
Used machines, complete	166,267	666,154	1,149,105
Parts	301,793	2,193,850	2,657,951
Total	2,191,933	13,672,936	19,010,285
- *Country of Origin*			
Western Germany	721,129	4,894,022	5,532,235
Switzerland	289,100	1,662,794	2,561,706
U.S. America	921,410	4,324,710	7,855,119
Other countries	260,294	2,791,410	3,061,225

Persona

MR. R. E. J. PUTMAN, A.M.I.Mech.E., has rejoined James Gordon & Co., Ltd., as chief engineer, after having spent several years in England and Canada during which he has been concerned with the application and development of electronic control equipment and systems for power stations, sugar factories, and oil fields, for example.

MR. R. CLARKE, O.B.E., M.I.Mar.E., owing to continued ill-health, has resigned from the board of Laurence, Scott & Electromotors, Ltd., where he held the position of marine sales director, after 48 years' service with the company. MR. J. B. WORMALL, M.I.E.E., who was formerly industrial sales director, is now sales director for all the company's products.

MR. S. H. L. KEARNS has been appointed a director of H. W. Kearns & Co., Ltd., Broadheath, nr. Manchester. Educated at Rugby, Mr. Kearns served an apprenticeship with Dean, Smith & Grace, Ltd., after completing his national service, and began work with H. W. Kearns & Co. in 1953. He has been trained in the various departments and is at present in charge of publicity.

MR. N. A. MORLING, who was appointed a director of Ferodo, Ltd., Chapel-en-le-Frith, Stockport, in July last, has succeeded MR. G. S. SUTCLIFFE as chairman of the company. Mr. Sutcliffe has resigned his directorship and has assumed the chairmanship of three other companies of the Turner & Newall Organization, namely Turner Brothers Asbestos Co., Ltd., J. W. Roberts, Ltd., and Glass Fabrics, Ltd.

MR. JESSE WOMBWELL, director and works manager of Imperial Typewriter Co., Ltd., East Park Road, Leicester, has retired and has relinquished his seat on the board after 42 years with the company. During this time he has played a major part in the development of the business. He has been succeeded as works manager by Mr. W. V. Ellingworth, who joined the company in 1951, and was appointed a director early in 1960.

MR. L. A. K. HALCOMB has retired from the position of managing director of Kayser, Ellison & Co., Ltd., Carlisle Steel Works, Sheffield, 4, but will continue to hold the office of chairman, and will remain on the board as a consultant. He will also remain a director of the parent company, Sanderson Kayser, Ltd. MR. J. R. A. BULL, chairman and managing director of Sanderson Kayser, Ltd., and Sanderson Brothers & Newbould, Ltd., is now managing director of Kayser, Ellison & Co., Ltd.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS.—January 25, at 6.30 p.m., in the Lecture Theatre, The Royal Aeronautical Society, 4 Hamilton Place, London, W.1; 1961 Lord Sempill paper on "The World's Future Transport Requirements," by Sir Percy Hunting. Admission will be by ticket only, obtainable on application to the secretary of the Institution, 10 Chesterfield Street, London, W.1. *Wolverhampton Graduate Section.* January 18, at 7 p.m., at the Wolverhampton and Staffs. College of Technology, Wulfruna Street, Wolverhampton; lecture on "The Application of Electronic Computers to Production Control," by B. L. J. Hart. *Peterborough Section.* January 18, at 7.30 p.m., in the Conference Room, Peterscourt, Peterborough; lecture on "Measurement of Time," by H. M. Smith, B.Sc. *London Graduate Section.* January 17, at 7.15 p.m., at the Institution, 10 Chesterfield Street, W.1; lecture on "Modern Welding Techniques," by W. H. Holland, and a film "New Welding Techniques." *Southampton Section.* January 19, at 7.15 p.m. at the Polygon Hotel, Southampton; lecture on "Production Control," by H. Horne.

INSTITUTION OF ELECTRICAL ENGINEERS.—*Western Utilization Group.* January 23, at 6 p.m., at S. Wales Institute of Engineers, Park Place, Cardiff; lecture on "The Utilization of Electricity in Steelworks," by T. B. Rolls, B.A.

INSTITUTION OF PLANT ENGINEERS.—*Kent Section.* January 18, at 7 p.m., at the King's Head Hotel, High Street, Rochester; lecture on "Photography in Industry," by N. E. Sherlock.

THE PLASTICS INSTITUTE.—*Midlands Section.* January 20, at 6.30 p.m., at the James Watt Memorial Institute, Great Charles Street, Birmingham; paper on "Automatic Moulding," by E. C. Gilbert.

Scrap Metals

*LONDON.—†Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £195; clean heavy copper, untinned and free from lead and solder, £190; copper wire No. 2, £185; clean light copper, £181; braziery copper, £167; gunmetal, £172; brass, mixed, £122; lead, net, £51; zinc, £41; cast aluminium, £95; old rolled aluminium, £98; battery lead, £25; unsweated brass radiators, £103; hollow pewter, £535; black pewter, £410.

MIDLANDS.—Although the buying prices of the steelworks are constant, the prices offered by merchants for scrap from local works have slightly improved. This increase is a direct result of extreme competition for the smaller tonnages now arising in this area due to the recession in the car industry. Merchants are trying to obtain larger tonnages to keep their plant and transport fully employed rather than declare redundancy during this period of smaller supplies.

Markets are available for all grades of scrap, and heavy steel from merchants' yards provides a regular source of supply. All steel turnings can be delivered to blast furnaces against open orders at prices from £7 per ton, to £9 per ton, approximately, according to quality.

The shortage of cast iron scrap is causing prices to increase by a few shillings per ton and merchants are hard pressed to maintain supplies to their regular customers. Short heavy steel for foundry use is moving steadily, supplies being sufficient for all demands.

Shortage of new light steel cuttings for baling persists, and presses are being employed for baling light iron and destructor scrap more and more each week.

With the shortage of scrap in the Midlands from the car and allied trades, the merchants are relying on deliveries to their yards of all grades from sundry sources, and prices for oversize scrap, in particular, are very attractive.

* George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12.
† Subject to market fluctuations.

Trade Publications

ROCKWELD, LIMITED., Commerce Way, Croydon.—Brochure concerned with the Circomatic seam welding machine and its application for storage tank construction. A specification of the machine is included, also a table of technical data, and illustrations showing the machine in use.

BRITISH GEON, LTD., Devonshire House, Piccadilly, London, W.1. Publication entitled "The Hycar Rubber Story," with an introductory section describing the manufacture and processing of butadiene/acrylonitrile rubbers. It is then explained how Hycar rubbers are used in various industries including those concerned with engineering, transport, aircraft, leather, and adhesives.

GEO. WALKER & SONS (BIRMINGHAM), LTD., Warwick Road, Tyseley, Birmingham, 11.—Brochure listing the complete range of high-speed steel milling cutters offered by the company, including: plain and helical mills; side and face cutters; slotting cutters; shell end-mills; angle cutters; convex and concave cutters; corner-rounding cutters; and gear cutters.

ROBERT KELLY & SONS, LTD., Excelsior Works, Hulme Hall Road, Chester Road, Manchester, 15.—Leaflet covering the Mk. 6 shrinking machine for channels, angles and flat sections, also the range of universal jaws for various types of presses and metal-working machines. Details of the Beighton filing and sawing machine and the Kelson No. 3 bench drilling machine are also included.

Machine Tool Share Market

Although business on the Stock Exchange was restricted by holiday influences, markets generally displayed a firm tone during the period under review. British Funds remained quietly steady as did other high-grade fixed interest stocks.

Interest in commercial and industrial share markets remained moderate and selective, and prices moved within narrow limits. Good features, however, were not lacking, and some modest gains were shown on balance.

Among machine tool issues, Arnott & Harrison advanced 6d. to 12s. 9d.; Asquith Machine Tool, 9d. to 12s. 6d.; British Oxygen, 1s. to 26s. 6d.; Churchill Machine Tool, 1½d. to 39s.; Geo Cohen, 3d. to 12s. 6d.; Craven Bros. (Manchester), 1½d. to 8s. 10½d.; John Holroyd "A," 1s. 3d. to 15s.; Kerry's (Gt. Britain), 3d. to 8s. 6d.; and John Shaw & Sons (Wolverhampton), 3d. to 16s. On the other hand Martin Bros. (Machinery) lost 9d. at 2s.; and Samuel Osborn, 3d. at 42s. 6d.

GREENWOOD & BATLEY, LTD.—Interim dividend 5 per cent.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	36/6
" "	5% Prf.	£1	16/6*
Arnott & Harrison, Ltd.	Ord.	4/-	12/9
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	12/6
" " "	6% Cum. Prf.	£1	18/9
Birmingham Small Arms Co., Ltd.	Ord.	10/-†	37/-
" " "	5% Cum. "A" Prf.	£1	14/6
" " "	6% Cum. "B" Prf.	£1	17/6
" " "	4% 1st Mort. Deb.	Stk.	90½
British Oxygen Co., Ltd.	Ord.	5/-	26/6xd
" " "	6% Cum. Prf.	£1	20/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	5/6
Broom & Wade, Ltd.	Ord.	5/-	22/3
" "	6% Cum. Prf.	£1	18/9
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	18/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	17/6xd
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	7/1½
" " "	6% Cum. Prf.	£1	25/9‡
Churchill Machine Tool Co., Ltd.	Ord.	5/-	39/-
" " "	6% Cum. Prf.	£1	18/-
Clarkson (Engrs.), Ltd.	Ord.	5/-	26/3
Cohen (George), 600 Group, Ltd.	Ord.	5/-	12/6
" " "	4½% Cum. Prf.	£1	13/9
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	23/-
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/10½
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/7½
" "	4½% Red. Cum. Prf.	£1	13/-
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	2/-
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	11/6
Greenwood & Batley, Ltd.	Ord.	10/-†	23/9 ex. Capn.
Harper (John) & Co., Ltd.	Ord.	5/-	8/6
" "	4½% Red. Cum. Prf.	£1	12/7½

COMPANY		Denom.	Middle Price
Herbert (Alfred), Ltd.	Ord.	£1	51/3
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	15/-
" " "	"B" Ord.	5/-	13/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	31/3
" " "	7% Cum. Prf.	5/-	5/-
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	17/6
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	8/6
Macreadys Metal Co., Ltd.	Ord.	5/-	15/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/-
Massey (B. & S.), Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	5/6
Newman Industries, Ltd.	Ord.	2/-	5/3
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	4/-
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	3/3
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	42/6
" " "	5½% Cum. Prf.	£1	25/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	14/9
Sanderson Kayser, Ltd.	Ord.	10/-	34/4½
" " "	6½% Cum. Prf.	£1	18/-
Scottish Machine Tool Corporation Ltd.	Ord.	4/-	10/-
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	44/9
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	16/-
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	15/3
" " " "	5% Cum. Prf.	£1	14/9
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	24/-
Tap & Die Corporation, Ltd.	Ord.	5/-	13/6
" " "	4½% Deb. 1961-1977	Stk.	84½
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	65/-
" "	5% Cum. 1st Pref.	£1	14/6
" "	5% Cum. 2nd Pref.	£1	23/-
Willson Lathes, Ltd.	Ord.	1/-	3/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Ordinary £1 shares have been subdivided and are now Ordinary 10/- units. ‡ Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig Iron

Foundry and Forge No. 3, Class 2

Middlesbrough (10 tons or over) £21 17 0
Birmingham (10 tons or over) £21 9 3

Phos. Over 0·1 up to 0·4%

Birmingham (6 ton lots) £23 5 0
Grangemouth (6 ton lots) £23 10 0

Hæmatite

English No. 1 (10 tons or over)

N.E. Coast (made in N.E.) £23 19 0
Scotland £24 5 6
Sheffield £25 9 0
Birmingham £25 13 0

Welsh 10 tons or over £23 19 0

Steel Products

Medium plates (50 tons andover) £43 16 6
Mild steel plates, ordinary (50 tons and over) £40 7 0
Boiler plates (50 tons and over) £42 17 0
Flat bars, 5 in. wide and under (50 tons or over) £39 1 0
Round bars, under 3 in. (50 tons or over) £39 1 0
Billets, rolling quality, soft U.T. (100 tons or over) £31 15 6

Phosphor Bronze

Ingots (2B8) (A.I.D. d/d £306 0 0

Copper

Cash (mean) £223 12 6
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG £300 5 0—302 15 0
Rods, 3/16 in. to ½ in. diam. £317 0 0
Tubes, 1¼ in. bore by 10 SWG, ton lots, per lb. 3s. 0½d.
Wire rod, black, hot-rolled (¼-5/16 in.), English £239 2 6

Zinc

Refined, minimum 98 per cent purity, current month (mean) £81 5 0

Brass

Tubes, solid drawn, per lb. 1s. 10d.
Strip 63/37, 6in. by 10 SWG coils, ton lots £252 15 0—£258 10 0
Rods, ¼-3 in. diam. (59 per cent copper) 2s. 0½d.

Yellow Metal

Condenser plates, per ton £188 0 0
Rods, per lb. 2s. 1½d.

Aluminium

Ingots, min. 99·5 per cent Canadian d/d £186 0 0

Tinplates

*U.K. Home trade:
Cold reduced, f.o.r. makers works (15-50 tons) £3 6 8
U.K. Export:
Hot rolled basis, f.o.r. works port 73s. 6d.—76s. 0d.
Cold reduced basis, f.o.r. works port 73s. 6d.—76s. 0d.

Gunmetal

Ingots, B.S. 1400 L.G.2, delivered £216 0 0

* Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f ex works, 2 ton basis £42 17 0
Free cutting black £47 6 6

Reeled Steel Bars[1]

Single-reeled, 1¼ in. upwards, f.o.t. works (+ usual extra for sizes) £43 9 6
Free cutting £47 19 0

Precision-ground Mild Steel[2]

1-in. diam. + 0·00025-in. 4-ton lots, per cwt. 121s. 6d.

Bright Ground Stainless Steel Bars[3]

EN56AM (martensitic, free cutting) £304 10 0
EN58AM (austenitic free cutting) £377 10 0
Prices are basic, subject to extras

High-speed Steel

Black random length bar. All prices basic, per lb., subject to extras:

Molybdenum "66" 6s. 5d.
Molybdenum "46" 6s. 3d.
14 per cent tungsten 6s. 11d.
16 per cent tungsten 7s. 4d.
18 per cent tungsten 7s. 9d.
22 per cent tungsten 9s. 2d.
5 per cent cobalt 10s. 10d.
4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2) 6s. 7d.

Precision-ground, High-speed Free-turning Brass Rod[2]

⅛-in. diam. ±0·00025-in., 2 ton lots, per lb. 2s. 9½d.

Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined 1/16-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
½ or ⅝ in.	252s. 8d.	328s. 5d.
1 or 1⅛ in.	201s. 3d.	259s. 5d.
1¼ to 1½ in.	142s. 0d.	176s. 4d.
1⅝ to 2 in.	109s. 4d.	129s. 8d.
2¼ to 3½ in.	94s. 3d.	109s. 6d.
3¾ to 12 in.	89s. 1d.	102s. 2d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. diam. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]
centreless ground 1 or 1⅛ in. 202s. 3d.
+0·010 in. Extra
for hardenable alloy iron[5] 1¼ to 1½ in. 142s. 0d.
1⅝in. to 2 in. 109s. 4d.
Per cwt. net 2¼ to 3½ in. 94s. 3d.

Stellite[6]

Welding Rods, plain

¼ in. diam., per lb. 30s. 0d.

Toolbits

¼ in. sq. × 4 in., each 22s. 3d.

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. 2 Pratt, Levick & Co., Ltd., Chester. 3 Spartan Steel & Alloys, Ltd., St. Stephens Street, Birmingham, 6. 4 Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. 5 "Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. 6 Deloro Stellite, Ltd., Highlands Road ,Shirley, Solihull.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn:
(Usaspead) over 1 to 2 in. £59 17 6
Lead bearing (Usaled) £64 4 0
Precision ground, 1½ in. £81 17

Bright Drawn

M.S. bars (M.M.C.) over 1¼ to 2 in. £55 3 6
Square edge flats (Usaflat) £72 0 0
M.S. angles (Usaspead) £99 0 0
Case hardening (EN) (Usacase) over 1¼ to 2 in. £63 3 0
M.S. bars (EN3B) (Usamild) over 1¼ to 2 in. £57 10 0
Carbon manganese semi-free cutting case hardening (EN202) (Usaspead 202) over 1¼ to 2 in. £72 14 6
35/45 ton tensile (EN6) (Usen) over 1 to 1¼ in. £65 4 0
0·4 carbon normalized (Usaspead "40") over 1¼ to 2 in. £67 6 0
0·45 carbon normalized EN9 (Usaspead 55) £67 16 0
Carbon manganese steel to Specification EN16T (Usaspead 5565), per ton £127 12 3

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices plus 5 per cent, less 5 per cent.

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.) ½ in. to 2½ in., per lb. 1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.), ½ in. to 2½ in., per lb. 4s. 2d.

Silver Steel

(0·194-in. to 1½-in.)
Genuine Stubs quality, per lb. 4s. 6d. + 5% less 27½%
M.M.C. quality, per lb. 2s. 6d. + 6½%
Boxes of 16 assorted sizes, 1/16 in. to ½ in. diam. 7s. 6d.

Stainless Steel

KE40AM (free cutting), per lb. 3s. 8d.

Glacier Machined Bronze Bars

Phosphor bronze (2B8), Lead bronze — Prices on application

High-speed Steel

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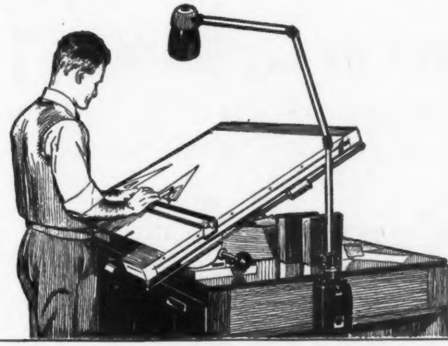

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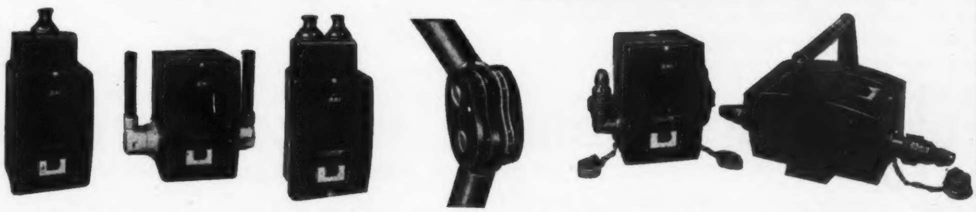

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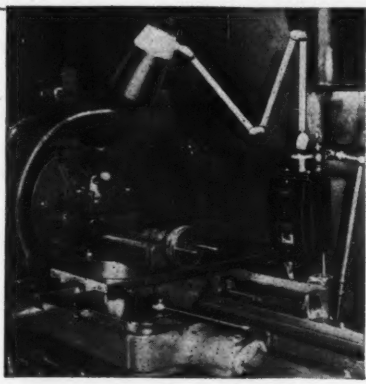

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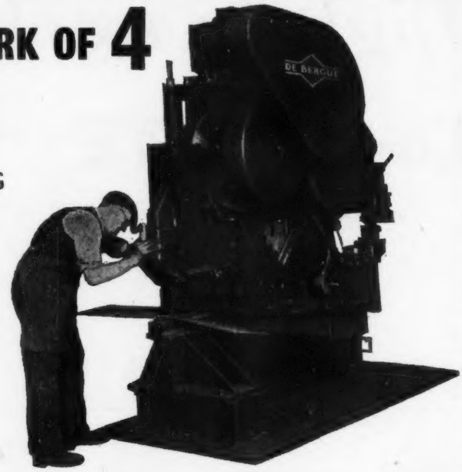

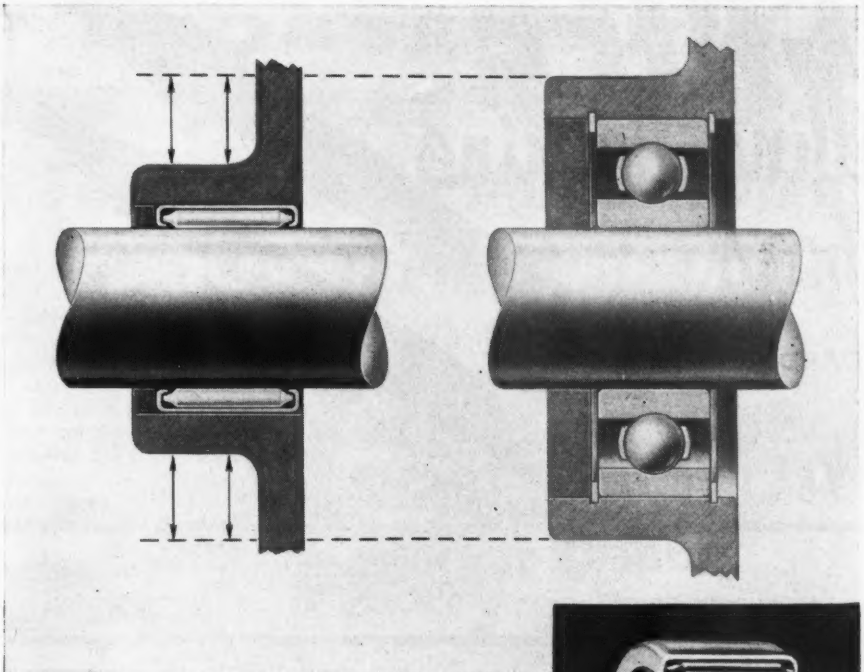

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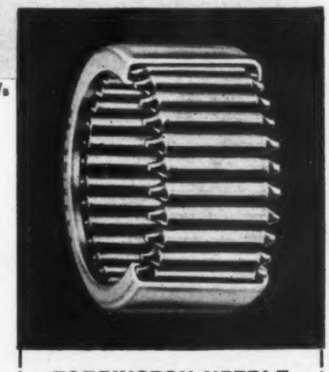

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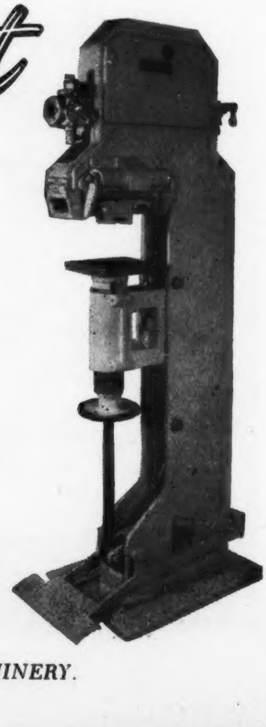

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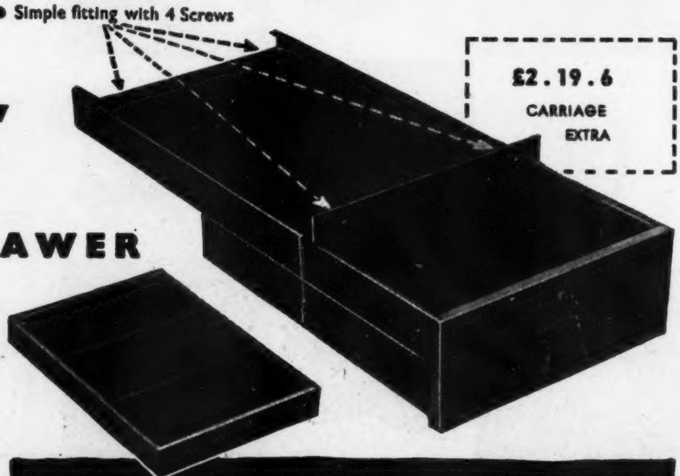

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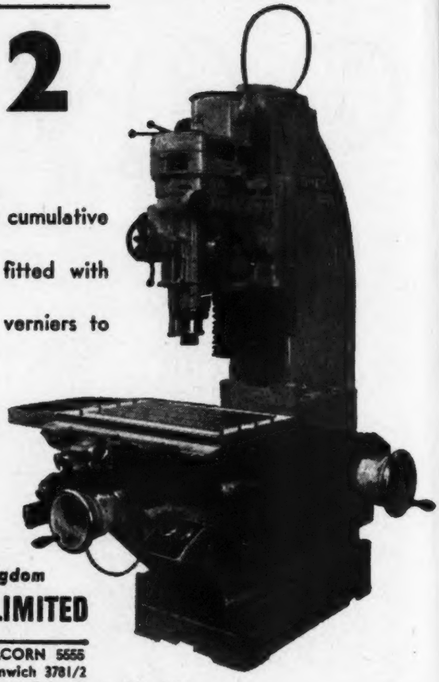

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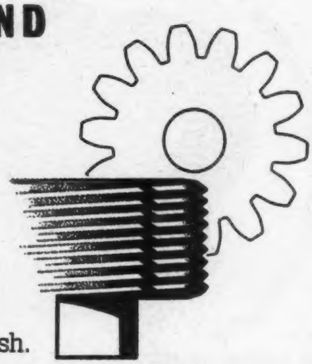

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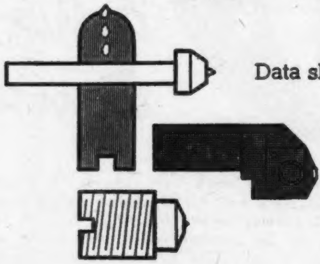

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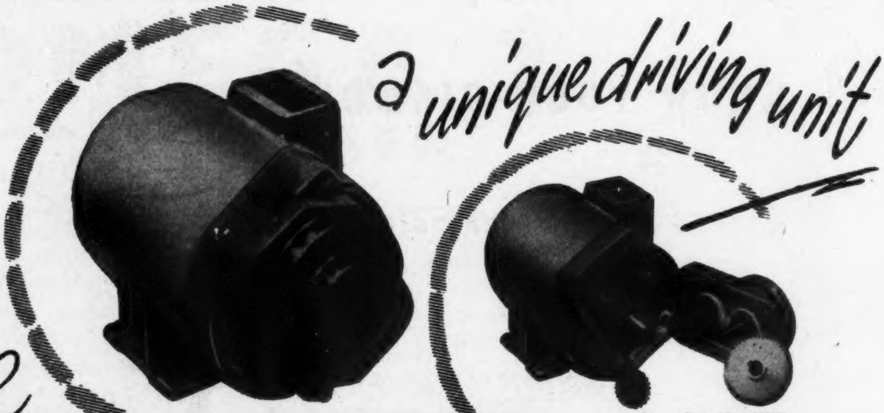

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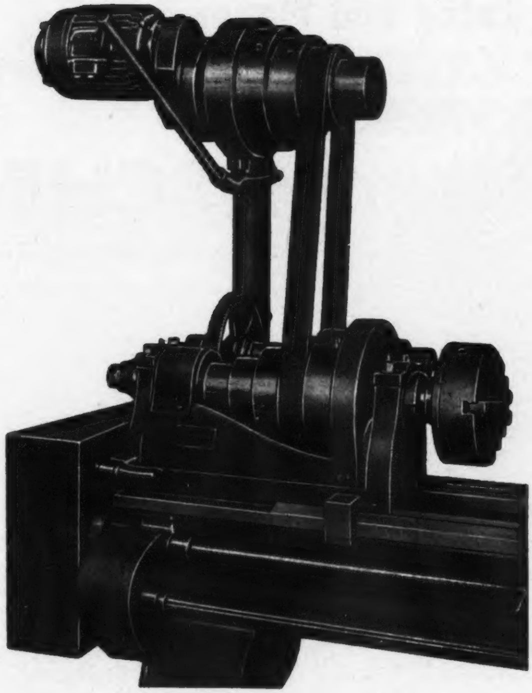

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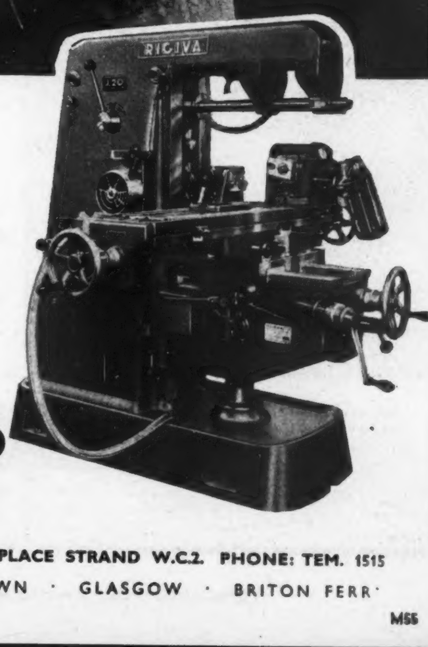

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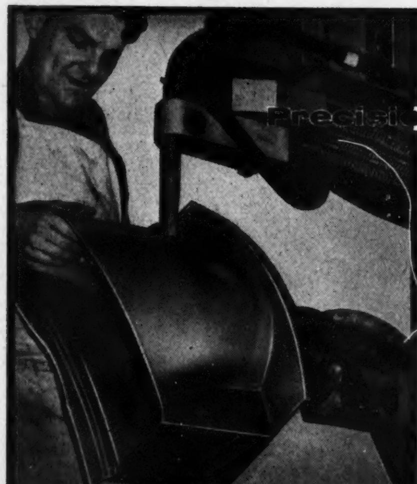

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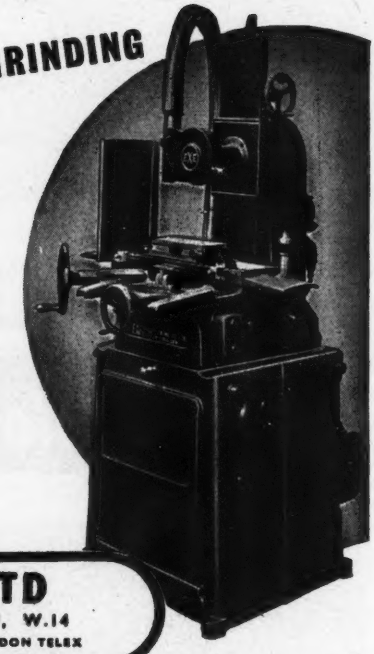

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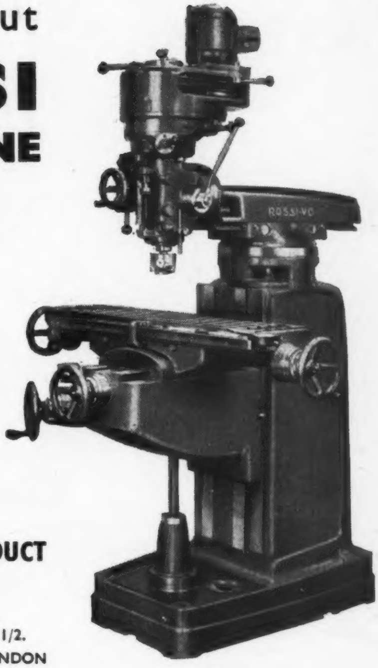

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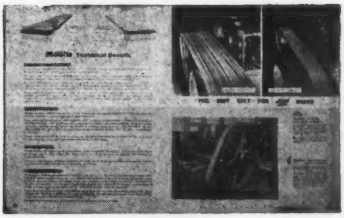

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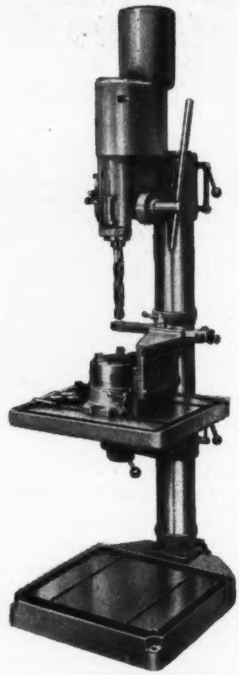

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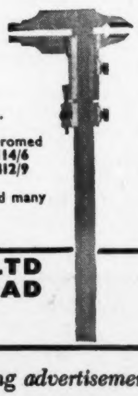

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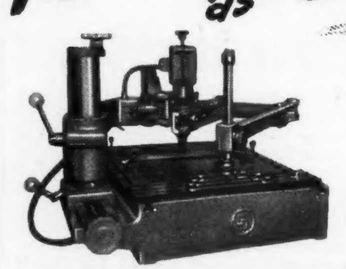

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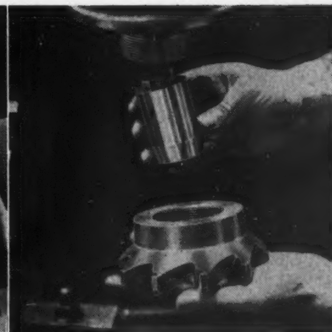
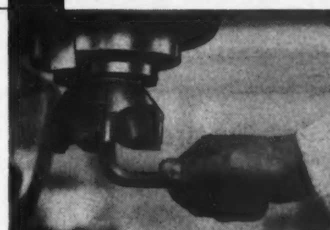


2 *Insert Marwin adaptor and screw on Marwin chuckmill to engage taper end.*



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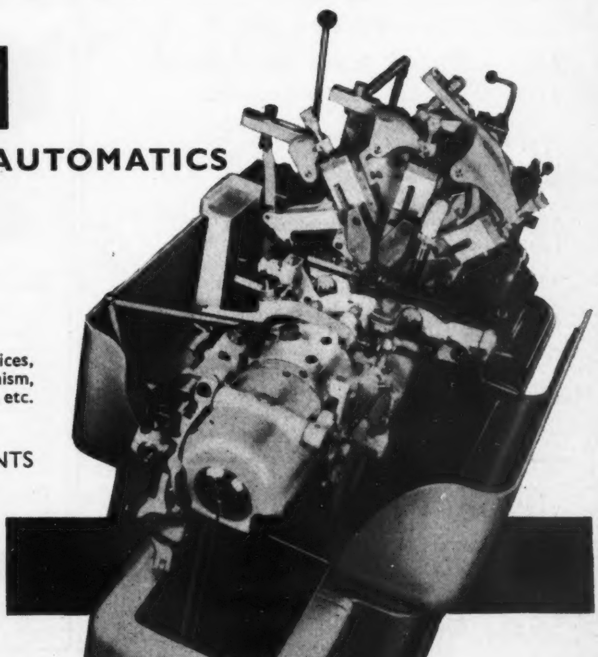

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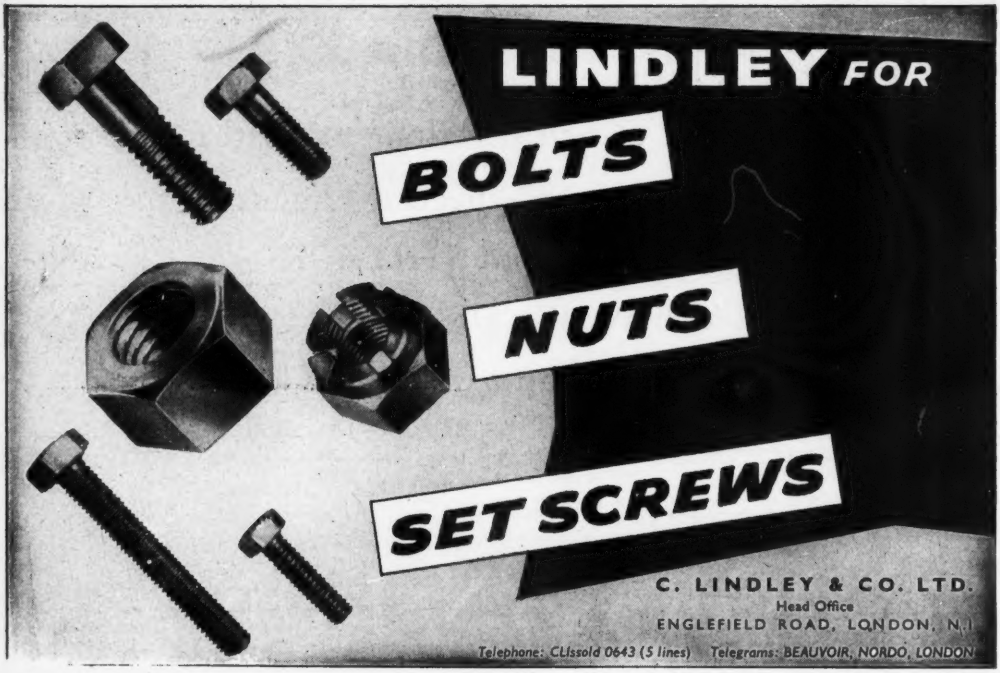

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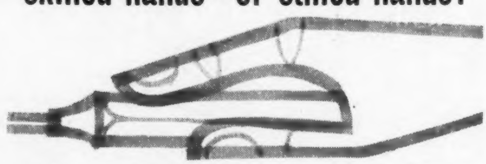

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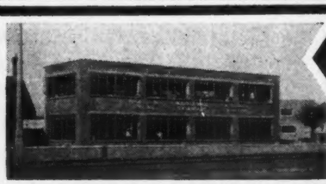

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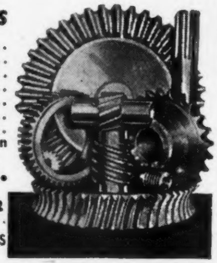

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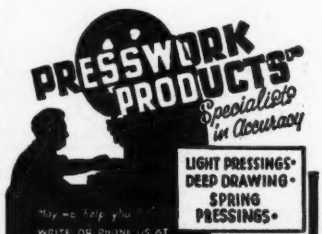

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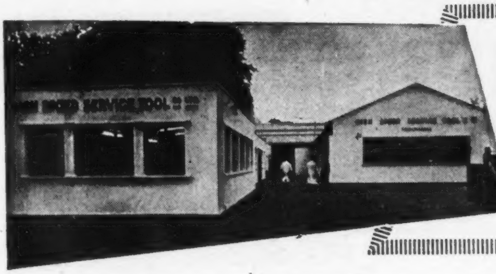

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BOX C418, MACHINERY, Clifton House, Euston Road, N.W.1.

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Kolb Gear Grinder, Type KZ 1.
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27in. **WOTAN** Hydraulic Shaper.
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24in. × 36in. **BULLARD** Vertical Borers.
4B **HERBERT** Bar Feed Capstan. Overhauled.
No. 2 **WARNER & SWASEY** Chucking Capstan.
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ABWOOD Vert. Sp. Surface, 18in. × 6in. £225.
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MURAD 3Q ¾ Capstan, collets and tooling. £225.
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SOUTHBEND 6½in. × 36in. QCGB. £95.
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SPRINGFIELD 14in. Swing F. & B. Lathe. £225.

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4ft. **KITCHEN & WADE** Centralised Control Radial Arm Drilling Machine. Spindle speeds 80-1,500 r.p.m. With tapping and reverse. Four rates of automatic feed. Maximum capacity in steel 3in. Cast iron 3½in. Power rise and fall to radial arm. Flange mounted motors, 30in. × 30in. × 36in. loose box table. Electric pump and fittings. Motorised 400/3/50.

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ASQUITH Model O.D.1 6ft. Heavy Duty Radial Drilling and Tapping Machine. Motorised 400/3/50 cycles, with loose box drilling table.
ASQUITH Model E.G.C. 6ft. Constructional Type Radial Drilling Machine, motorised 400/3/50 cycles.
KITCHEN & WADE 4ft. All Electric Redial Drilling and Tapping Machine, with low base and loose box drilling table, spindle bored No. 4 M.T., spindle speeds 80/1,500 r.p.m., motorised 400/3/50 supply.
ASQUITH 5ft. 9in. Portable Universal Radial Drilling Machine, motorised 400/3/50 cycles.

BORING MACHINES

GRAHAM & NORMANTON Surfacing and Boring Lathe, with Norton type screwcutting gearbox, 42in. swing in gap, 18 spindle speeds 9/461, Motorised 400/3/50 cycles.
WEBSTER & BENNETT 36in. Vertical Boring Mill, with side head, motorised 400/3/50 cycles.
WEBSTER & BENNETT 48in. Single Column Type Vert. Boring Mill, mot. 400/3/50 cycles.

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BUTLER 8in. stroke Production type Slotting Machine, 20in. dia. rotary table. Motorised 400/3/50 cycles.
BUTLER 14in. stroke Slotting Machine, with 30in. rotary table, Motorised 400/3/50 cycles.
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STIRK 8ft. 0in. × 4ft. 6in. × 4ft. 6in. Double Column Type All Electric Planing Machine, 4 toolboxes.

LATHES

WARD No. 8 Covered Bed Combination Turret Lathe, arranged for chuck work, 16 spindle speeds 25-1,000 r.p.m., motorised 400/3/50 cycles supply.
DENHAM 9in. S.S. & S.C. All Geared Head Gap Bed Lathe, admit 4ft. 3in. between centres, Motorised 400/3/50 cycles.
LANG 15in. Centre Lathe, 2 saddles, admit 17ft. 6in. between centres, mot, 400/3/50 cy.
LANG 18in. Centre Lathe, one saddle, admit 10ft. 6in. between centres, mot. 400/3/50 cy.

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CINCINNATI No. 3 Semi-Dial Type Vertical Milling Machine, working surface of table 50in. by 18in., spindle speeds 18/450, Motorised 400/3/50 cycles.
C.V.A. "Kearney & Trecker" model 2E Dial Type Horizontal Plain Milling Machine, working surface of table 41in. × 12in., longitudinal feed 29in., cross feed 12in., 8 spindle speeds 25/1,000 r.p.m., motorised 400/3/50 supply.
CINCINNATI Model 3/36 Hydromatic Milling Machine, table 54in. × 14in., motorised 400/3/50 cycles.
MANN Vertical Milling Machine, with swivel head, dial change to spindle speeds and feeds, table 46in. × 12in., 9 speeds 48/750 r.p.m., motorised 400/3/50 supply.
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Ward No. 7 Capstan Lathe, AGH. Speeds 50-1,000. Arranged for bar work. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19. Northern 1234/5.

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SONDERMANN & STIER 8ft. Double Column Heavy Duty Vertical Boring and Turning Mill, with side head, swing 104in. dia., admit 58in. high table to cross slide, 35 h.p. motor.

PENSOTTI KTV.1050 Turret Type Vertical Boring and Turning Mill, with side head, swing 43in. dia., table speeds 10 to 125 r.p.m.

WEBSTER & BENNETT 48in. Single Column Turret Type Vertical Boring and Turning Mill, to swing 104in. dia. Taper Turning Attachment, 35 h.p. motor.

ASQUITH OD.1 4ft. Radial Drilling Machine, No. 5 Morse Taper.

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SNOW Model T.20 Table Type Surface Grinding Machine, with extended table, dust extractor, etc. Three machines available. In excellent condition.

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WARD No. 13 Combination Turret Lathe, covered bed, 25in. concentric chuck, 27in. 4-jaw independent chuck, good turret tooling, taper turning attachment. 35 h.p. motor, 400/3/50. Modern Machine. Excellent condition.

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MINGANTI 20-40P Hydraulic Pre-Selector Bar Feed Capstan Lathe, 14½in. swing, 1⅝in. collet chuck, speeds 60 to 1,500 r.p.m. 400/3/50.

WARD No. 3A Chucking Capstan Lathe, 13in. swing, 1⅝in. hollow spindle, speeds 42 to 825 r.p.m. 400/3/50.

WARD No. 2A Bar Feed Capstan Lathe, 11in. swing, 1⅝in. hollow spindle, speeds 48 to 1,020 r.p.m. 400/3/50.

GORTON 9.J Duplicating and Diesinking Machine. Table working surface 35in. × 10½in. Hand operated duplicator table.

CINCINNATI No. 4 Dial Type High-Speed Plain Horizontal Milling Machine, oversize table 86½in. × 16½in.

SOMUA FV.4B Vertical Milling Machine, table 75in. × 16in.

MILWAUKEE 3H Vertical Milling Machine. Table 75in. × 16in.

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R. O. GRAY

HERBERT No. 2S Capstan Lathe, with bar feed, 400/3/50.

DRUMMOND Model K Capstan Lathe, chucking, 400/3/50.

GISHOLT No. 4 Capstan Lathe, chucking, 400/3/50.

WARD 2A Capstan Lathe. 415/3/50. Automatic chuck and bar feed.

WARD No. 7 Capstan Lathe, 415/3/50, arranged for chucking.

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Two **MOREY** 1in. High Speed Turret Lathes, 415/3/50, fitted with three-jaw chuck.

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GRAHAM-NORMANTON S.S. & S.C. Gap Bed Lathe. 415/3/50. Short bed, admits 2ft. between centres. 9in. height of centres, swing in gap 33in. dia., 2in. HS.

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ARCHDALE Swivel Head Vertical Milling Machine. 415/3/50. Table W.S. 36in. × 10in.

TRIDENT Model V.O. Swivel Head Vertical Milling Machine. 415/3/50. Table W.S. 30in. × 8in.

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ASQUITH Twin Spindle Profile Milling Machine. 415/3/50.

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V.D.F. 8in. Toolroom Lathe, Model S.400 with lead screw, 4 t.p.i., swing between centres 60in. +; spindle capacity 1⅞in. diameter; 415v. 3 phase 10.2 h.p. motor; electro-magnetic clutch. Also with pre-selector gear change; speeds range 11.2-1,800 r.p.m.; taper turning and copying attachment; boring tailstock with multi-feed; automatic feed and compound slide; quick change toolpost and full set of tool holders; 6in., 8in. and 10in. 3-jaw chucks, 12in. 4-jaw chuck. Complete with machine light, power meter, coolant tanks, pumps, etc. Cost £3,500; £2,000 or offer.—Machine now running at ELECTRO MECHANISMS, LTD., 220, Bedford Avenue, Trading Estate, Slough, Bucks. Slough 22228. Enquirers should ask for Mr. Hillier.

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MT.37867. LANG 14in. All Geared Head Straight Bed S.S. & S.C. Centre Lathe. Admits 8ft. between centres. Spindle speeds 6·5 to 330 r.p.m. Fitted with enclosed feed gear box. With taper turning attachment. Motor drive 400-440/3/50. **Price: £1,300.**

MT.38247. LANG JUNIOR 13in. swing Surfacing and Boring Lathe. Max. distance chuck to turret face 33in. Spindle speeds 37 to 908 r.p.m. Motor drive 400/3/50. **Price: £410.**

MT.38246. LANG 32in. swing All Geared Head S.S. & S.C. Surfacing and Boring Lathe. Max. distance chuck to turret face 49in. Spindle speeds 6·8 to 338 r.p.m. Fitted with Norton type feed gear box and taper turning attachment. Motor drive 400/3/50. **Price: £1,050.**

MT.38525/MT.38526. WARD No. 1A Capstan Lathe. 1in. bar capacity. Hand feed to turret. Spindle speeds 75 to 4,130 r.p.m. With dead length ball chuck and bar feed. Motor drive 400/3/50. Two available. **Price each: £225.**

MT.38528/MT.38529. HERBERT No. 2S Capstan Lathe. 1¾in. bar capacity. Power feed to turret. With dead length ball chuck and bar feed. Motor drive 400/3/50. Two available. **Price each: £275.**

MT.38510/MT.38511. WARD No. 2A Capstan Lathe. 1¼in. bar capacity. Power feed to turret. Spindle speeds 48 to 1,020 r.p.m. With dead length ball chuck and bar feed. Motor drive 400/3/50. Two available. **Price each: £425.**

MT.38517. WARD 3A Capstan Lathe. 1½in. bar capacity. Power feed to turret. Spindle speeds 42 to 825 r.p.m. With dead length ball chuck and bar feed. Motor drive 400/3/50. **Price: £650.**

MT.37879/80. WARD No. 10. Covered Bed Combination Turret Lathe. Spindle speeds 16 to 470 r.p.m. Power feed to turret and saddle. Arranged for chuck work. Fitted with Taper. Turning Attachment. Motor drive 400/3/50. Two available. **Price each: £1,475.**

MT.38497/8. KEARNS No. 2 Horizontal Boring Machine. 3in. dia. traversing spindle. Fitted with facing head. Spindle speeds 3·7 to 374 r.p.m. Main table 30in. by 48in. Auxiliary table 36in. square. Motor drive 400/3/50. Two available. **Price each: £3,250.**

MT.38496. RICHARDS No. 2 Model PRTn Horizontal Boring Machine. 3in. dia. traversing spindle. Fitted with facing head. Spindle speeds 79 to 300 r.p.m. Facing Head speeds 3·5 to 280 r.p.m. Main table 30in. by 48in. Auxiliary table 36in. square. Motor drive 400/3/50. **Price: £3,750.**

MT.38278. WEBSTER & BENNETT 48in. Vertical Boring and Turning Mill. Max. swing 54in. 12 table speeds, 4·5 to 100 r.p.m. Fitted with pentagonal tool turret. Motor drive 400/3/50. **Price: £1,425.**

MT.38500/1. ASQUITH Model L.D.1 4ft. 6in. Low Base Radial Drilling Machine. Spindle bored No. 4 M.T. Spindle speeds up to 1,000 r.p.m. Power feed to spindle. Tee slotted base. With loose box table. Motor drive. Two available. **Price each: £700.**

MT.38542. ARCHDALE 4-spindle Drilling Machine. Spindles bored No. 3 M.T. Power feed to all spindles. Spindle speeds from 98 to 2,900 r.p.m. by pole change motor. With coolant pump and tank. Motor drive 400/3/50. **Price: £425.**

MT.38535. PARKSON Model 1.N.A. Universal Milling Machine. Table size 10½in. by 44in. Spindle speeds up to 450 r.p.m. With vertical attachment. Motor drive 400/3/50. **Price: £675.**

MT.38537. CINCINNATI No. 4 Dial Type Plain Horizontal Milling Machine. Table size 16¼in. by 86in. Spindle speeds 18 to 450 r.p.m. Power feeds and rapid traverse in all directions. With vertical attachment. Motor drive 400/3/50. **Price: £1,850.**

MT.66543/4. ROWLAND Type A.T.H. 30in. Heavy Duty Double Ended Grinding Machine. Max. wheel size 30in. by 4in. Distance between wheels 5ft. 7in. Three speeds to spindle. Complete with dust extraction unit. Motor drive 400/3/50. Two available. **Price each: £255.**

MT.38263. KITCHEN & WADE 3ft. 6in. Low Base Radial Drilling Machine. Spindle bored No. 5. M.T. Spindle speeds 22 to 1,000 r.p.m. Power feed to spindle. Tee section triple base. With pivot mounted box table. Motor drive 400/3/50. **Price: £695.**

MT.38490. ARCHDALE 18in. High Speed Vertical Milling Machine. Table size 10in. by 29in. Spindle speeds 79 to 2,000 r.p.m. Power feed to longitudinal traverse. Motor drive 400/3/50. **Price: £475.**

MT.38493/4. GORTON Model 9.J. Vertical Milling Machine. Table size 10½in. by 33in. Spindle speeds 620 to 3,340 r.p.m. Separate motor drive to table feeds. Motor drive 400/3/50. Two available. **Price each: £450.**

MT.38539. CINCINNATI No. 3 Dial Type Vertical Milling Machine. Table size 15in. by 62in. Spindle speeds 18 to 450 r.p.m. Power feeds and rapid traverse in all directions. Motor drive 400/3/50. **Price: £1,350.**

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Two **CLEVELAND** $\frac{7}{16}$in. Model A Single Spindle Autos.
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GISHOLT No. 5 Capstan Lathe, 3in. hollow spindle.
ACME GRIDLEY $3\frac{1}{16}$in. 4-spindle Bar Automatic.
HERBERT No. 9 Combination Turret Lathe.
CHURCHILL-REDMAN Gap Bed Surface and Boring Lathe, centre height 12in., distance spindle to turret 56in. Swing in gap 40in.
SWIFT Hydraulic Copying Lathe, 36in. swing × 5ft. 6in. b.c., 30 h.p. drive.

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ARCHDALE 28in. Horizontal Miller.
PENSOTTI Thread Miller, capcity 10in. dia. × 13ft.
VICTORIA u.1 Universal Miller with vertical attachment.
BROWN & SHARPE No. 2 Vertical Mill, table 54in. × 14in., speeds 30-1,200 r.p.m. Power down feed to head.
HURTH Single Head Keyseater, table 26in. × 9in.
SCHIESS DEFRIES Vertical Keyseater.

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30 ton **RASKIN** Double Sided Double Geared Drawing Press. Area 20in. × 23in. Draw $4\frac{1}{2}$in.

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24in. **INVICTA** 6 m. Shaper.
MAXICUT High Speed Gear Shaper, max. dia. 7in. × 2in. face.
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MISCELLANEOUS

6in. Power Hack Saw.
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RAIG & DONALD 4 Roll Bending and Flattening Rolls, 4ft. × ⅜in. cap.

BORING MACHINES

KEARNS No. 2 Patent Horizontal Borer. Trav. spindle and facing head.

RICHARDS 4ft. swing Vertical Borer. Double Column. Two rams.

DRILLING MACHINES

POLLARD 13in. Pillar Drill. No. 2 Morse Taper. R. & F. Table 11in. × 11in.

KITCHEN & WADE 12ft. Radial Drill. Spindle to base 8ft. 9in. Speeds 8-800 r.p.m.

GRINDING MACHINES

ELB 24in. × 8in. Hydraulic Surface Grinder. Non-electric mag. chuck.

LUMSDEN Double Ended Grinder. Wheels 24in. dia. × 4in. wide.

New **NORTON** 10in., 12in., 14in., 16in. and 20in. D/E Tool Grinders.

CAPSTAN AND CENTRE LATHES

WARD 8 Combination Turret Lathe. Covered Bed.

WARD 10 Combination Turret Lathe. Covered Bed.

HENDEY 9in. S.S. & S.C. Lathe. 12 speeds 14-478 r.p.m. Taper turning 4ft. 6in. between centres.

LANG 20in. C.H. × 5ft. 9in. B.C. S.S. & S.C. Lathe.

MILLING MACHINES

WANDERER Heavy Duty Vertical Miller. Table 65in. × 13¾in. Speeds to 800 r.p.m. Swivel head. Power and quick power.

PLANING MACHINES

BOEHRINGER 10ft. Openside Planing Machine. 1 toolbox on cross-rail, 1 side-box. Electric drive and reversing.

PRESSES

BRADLEY & TURTON No. 3 Flypress.

SWEENEY & BLOCKSIDGE Bench Press. Cap. 3 tons.

SHAPING MACHINES

WOTAN 27in. stroke Hydraulic Shaper.

POLISHING MACHINES

3 and 5 h.p. Polishing Spindles.

All machines 400/3/50 electrics unless otherwise stated.

THE
MIDLAND MACHINE TOOL CO.
BRADLEY, BILSTON, STAFFS.
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SERVICE EDWARDS VALUE!

BLISS No. 6H. Geared Inclinable Power Press Motorised for 400-440/3/50 supply. Pressure exerted approx. 60 tons. Stroke 6in. Bed 32¾in. × 22in. Hole in bed 17¾in. × 12¾in. Complete with low voltage lighting unit and detachable front tie bars. Weight approx. 95 cwt.

Hand Operated Universal Folding Machine. With high lift clamping beam. Capacity 6ft. × 14 s.w.g. Front folding beam adjustable for round or sharp bends. With adjustable back gauge and angle stop for repetition bending. Weight approx. 18 cwt.

BUFFALO FORGE Horizontal Section Rolling Machine. Motorised for 220-440/3/50 supply. Capacity angles leg out 2in. × 2in. × ¼in. Angles leg in 1½in. × 1½in. × ¼in. Flats on edge 2in. × ⅜in. Flats on flat 5in. × ⅜in. Rolling speed 40ft. per minute. Weight approx. 30 cwt.

BRADLEY & CRAVEN Geared Press Brake. Motorised for 400-440/3/50 supply. Maximum pressure approx. 65 tons. Forming capacity 10ft. × 12 s.w.g. over die opening of ⅜in., or 8ft. × ¼in. over die opening of 1½in. Between frames 101¾in. Weight approx. 8½ tons.

CRAIG & DONALD Deep Gap Guillotine Shearing Machine. Motorised for 440/3/50 supply. With automatic hold-down and adjustable back gauge. Capacity 14ft. × ⅜in. Complete with three spare sets of blades Weight approx. 11 tons.

FOUR **BLACKBURN & CRAWSHAW** Rotary Shearing Machines. Motorised for 400/3/50 supply. Fitted with adjustable gauge. Capacity ¼in. thickness. Cutters 5½in. diameter × ⅜in. thickness. Cutting speed 5ft. 6in. per minute. Weight approx. 10½ cwt.

RHODES Motorised Double Geared Press Brake. With cast iron side frames, reinforced by nickel-chrome steel bars. Bed and top beam of steel plate. Direct geared motor drive for 400/3/50. Pressure exerted approx. 150 tons. Forming capacity 10ft. × $\frac{5}{16}$in.; or 18ft. × approx. ¼in. Clear width between housings 10ft. 2in. Weight approx. 20 tons.

Photographs of the above are available.

VERY FAVOURABLE HIRE PURCHASE TERMS CAN BE OBTAINED.

MACHINE TOOLS, NEW AND USED. Of Every Description. Attractive Prices.

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Hydraulic Precision Universal Grinding Machine, Jones & Shipman, size 12in. × 36in., with standard equipment and internal spindle. Excellent condition.—BOX C 476, MACHINERY, Clifton House, Euston Road, N.W.1.

Cridan Sentinel B High Speed Screwcutting Machine. Serial No. 32001. Just overhauled.—BOX C480. MACHINERY, Clifton House, Euston Road, N.W.1.

Drummond Maxicut No. 2 Multi-tool Lathe, 30in. between centres. Swing 22in., longitudinal saddle movement 18in., fitted with extra slides on front and rear toolposts. Auto. return to slides. Motorised 45 h.p., 400-440/3/50.—BOX C 450, MACHINERY, Clifton House, Euston Road, N.W.1.

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Further details from —
C. & G. OLDFIELD, LTD.
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Newman

AUTOMATICS

BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.
ASQUITH Horizontal Floor Boring Machine, 7in. diameter travelling spindle.
GIDDINGS & LEWIS No. 45 Horizontal Boring Machine, 5in. diameter travelling spindle.

CAPSTAN AND CENTRE LATHES

HERBERT No. 12 Combination Turret Lathe, 6½in. diameter hollow spindle.
NILES Heavy Duty Centre Lathe, S.S. & S.C. 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30ft. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.
TOWN Radial Drilling Machine, 4ft. 6in. elevating arm. (NEW.)
TOWN 30in. Single Spindle Boring and Drilling Machine.

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ORCUTT Model HM.24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

LANDIS Plain Hydraulic Cylindrical Grinding Machine, 18in. swing by 72in. between centres.
ORCUTT Model HM.24 Internal Spur Gear Grinding Machine.
CHURCHILL Crankshaft Grinding Machine 26in. swing × 84in. between centres.
CHURCHILL Turret Type Hydraulic Universal Grinding Machine, 16in. swing × 50in. between centres.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 72in. between centres.
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B.S.A. LANDIS Plain Cylindrical Grinding Machine, 6in. swing × 30in. between centres.
T.O.S. Vertical Spindle Hydraulic Surface Grinding Machine, table working surface 118in. × 24in. (NEW.)

MILLING MACHINES

CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial type Horizontal Milling Machine.
GRAFFENSTADEN Model FH.101 Plain Horizontal Milling Machine, table 52in. × 10in.
TECHNOIMPEX Universal Horizontal Milling Machine, table 59in. × 16in. (NEW.)
SUNDSTRAND Hydroscrew Rigid Mill Horizontal Production Milling Machine, table 78in. × 14in.
PRATT & WHITNEY Model BL.3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

NEWMAN INDUSTRIES LIMITED,
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CAPSTANS
MINGANTI 20/40P 1 9/16 cap. Bar feed.
GISHOLT IL Turret.

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ARCHDALE 28in. Prod. Four speeds.
ARCHDALE 28in. Prod. tapping.
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CORONA 15AX 1¼ capacity.
JONES & SHIPMAN 816, 3/16in. cap.
CORONA 1AX No. 1 Morse Taper.
CORONA 15 HF 3/16in. cap.
HAUSER 5/16 Precision.
PEGARD 3ft. 6in. Radial.
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STEINEL Cluster Type.
CORONA 6MX Cluster Type.
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ARCHDALE 21in. Production.
CORONA 12AX, 3/16in. cap.

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T.T. & H. 3DS Three Dimensional.
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RAPIDOR Filing.

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Sheet Edging, 30in. × 22g.

GEAR CUTTERS
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EXCEL No. 2 14 × 6 hand.
LUMSDEN Vert., 210 XXM.
SNOW Table 20in.
ABRASIVE No. 34 Vertical Spindle.
ABRASIVE 3B, 24in. × 8in.
ABRASIVE No. 1½in. hand.

GRINDERS (Internal)
BRYANT 16/38.
NEWALL Model KN.

GRINDERS (Cylindrical)
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COVENTRY GAUGE 6in. × 12in.
CHURCHILL 7 × 36in.
CHURCHILL PBH 12 × 36in. Uni.
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J. & S. Drill ⅛ to ⅞.
STEDALL WUNDERLI Carbide.
TAUCO 10in. Abrasive Cut off.
ROWLAND 12in. × 2in. Single Wheel.
ABWOOD Carbide.
WICKMAN NIVEN Carbide.
WADKIN Saw Sharpener.
TURNER T. & C.
UNION G14 D.E. Tool, 14in. × 2in. wheel.
BLACK DIAMOND No. 2 Drill.
JACKMAN D/E 18in. Disc.
EXCEL Model OS, T. & C.
TURNER 14/20 20in. × 3½in. wheels C/E.
MATRIX No. 10 × 10in. Plain Thread.
NEWALL 420 Univ. Thread for taps.
HUNT No. 0 and 1 Tap Regrinders.
HUNT No. 0 and 2 Drill.
NEWALL 836 Thread.

KEYSEATERS
BENTLEY 5in.
ASQUITH H.K.O. Horiz. Duplex.
EDGWICK 4in.

LATHES
WILLSON 8½in. Copying Att.
SWIFT 12 SV5, facing and boring.
SMART & BROWN 4in. Plain.
PRATT & WHITNEY 12in. × 30in. S.S. & S.C.
MONARCH 10EE × 22in., S.S. & S.C.
SMALLPIECE 12in. × 20in. Multi-tool.
LORCH A11 Precision.
DENHAM 5in. S.S. & S.C.
RIVETT 3½in. Plain. Model 715.
WARD, HAGGAS & SMITH 8½in. × 78in.
COULTHURST Surfacing and Boring.
RYDERMATIC No. 12 Multi Tool.

MILLERS (Horizontal)
DENBIGH Type C.
ACCURAMILL 17¾ × 5 table, lever.
ROSCHER EICHLER, Table 39in. × 12in.
SUNDSTRAND No. 0 Production.
PALLAS LM, Table 30in. × 7in.
ST. ANDREA Model UFO3.
ADCOCK & SHIPLEY Model OCD.
KENT OWEN 1/8 and 1/14 Production.
HARDINGE Precision.
WERNER. Table 14 × 5.
JONES 225 Univ. Table 22 × 6.
ARCHDALE 28in. and 20in.

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C.V.A. 79 Tool and Die.
PALLAS VI. Table 30 × 8½.
REED PRENTICE No. 5, 68in. × 16in. table.
MILNE. Table 30in. × 8in.
WADKIN Type LXIA. Table 36in. × 13in.

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STENELCO Toggle.
APEX Treadle.
NORTON No. 4.

PRESSES (Power)
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GERMAN Rotary Punch.
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SCHULER VZZ, 15 tons d/s gripper feed.

PROFILING MACHINE
CURDNUBE 2 Spindle. Model KIV.

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HIGH SPEED Hammer, 7/16 cap.
TURNER RH 18 (⅛in.).
TURNER RH 14/12 (¼in.) RS6 (⅜in.).

SCREWING MACHINE
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SHAPERS
INVICTA 24in.
NEWEY 14in.

SLOTTER
BENTLEY 4in.

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ESSEX No. 124, ½in. cap.
THIEL No. 4, ⅛-9/32nds.
ACE Horiz., ½in. capacity.
HASKINS Type 3 C.A.M., ½in. cap.
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Kearns Horizontal Boring Machine, model "O." Table size 36in. × 36in., longitudinal traverse 40in., transverse motion 15in., spindle bore No. 5 morse taper. Speeds 72 to 620 r.p.m. Three speed motor. Cheap to clear.—BOX C458, MACHINERY, Clifton House, Euston Road, N.W.1.

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Oil Extractor Broadbent Bottom discharge Type 14 Centrifuge.
Herbert Type B, 18,000 r.p.m., Bench Drill, ½in. Chuck.
Hand Press, No. 4. Vizor.
Nut tapping attachment for 48 B.S.A. Auto.
All in good condition.

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CARDIFF Centre Lathe, 7½in. × 40in., 3 and 4 Jaw Chucks, Taper Turning Attachment, Electric Suds, etc., 400/3/50. £450.
DEAN, SMITH & GRACE Centre Lathe, 6½in. × 36in., 3 and 4 Jaw Chucks, Faceplate, etc., 400/3/50. £350.
ROLLO Centre Lathe, 6½in. × 36in., 3 Jaw Chuck, Faceplate, etc., 400/3/50. £145.
EDWARDS 48in. Power Guillotine, 14 Gauge, 400/3/50. £250.
ALBA 22in. Shaper, 400/3/50. £195.
TOWN 6ft. Radial Drill, 20 speeds up to 500 r.p.m., power lift to arm, box table, 400/3/50. £295.
T.T.H. 2 Dimensional Engraving Machine, Model MA., 400/3/50. £75.

PLEASE WRITE FOR LISTS

Churchill-Redman 12in. × 40in. Semi-Automatic Hydraulic Profiling Lathe. Hydraulic chuck and tailstock. Front profiling slide, rear facing slide, 15 h.p., two-speed motor. Post-war machine. Excellent condition. —LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

Cincinnati 4/48 Duplex Hydromatic Production Milling Machine.
LUND PRECIMAX Model MPH 10in. × 36in. Plain Cylindrical Grinder.
WARD Nos. 16, 10/13, 10B, 7B Combination Turret Lathes, covered beds. Also Ward OE Capstan Lathes.
CHURCHILL SLIDEWAY GRINDER, openside, 35in. stroke, hydraulic. £750.
GIDDINGS & LEWIS NO. 25 RT Horizontal Borer, 2½in. spindle, 17in. Facing Head.
ARCHDALE RADIAL DRILL, heavy duty low base and loose table.

HELIOT,
35, Greenwich Church Street, London, S.E.10.

Landis 10in. × 24in. Type "C" Universal Grinder. Internal Attachment. New condition.
Further details from:—
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**STIRK VELOPLANE
PLANING MACHINE**

8ft. by 3ft. by 3ft. 3 Toolboxes. Excellent condition. Motorised 400/3/50.

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When answering advertisements kindly mention MACHINERY.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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LEEDS 63-7398

Bryant No. 4 Internal Chucking Grinder. Capacity ½in.-2in. bore. Max. swing 6½in. dia. Motorised.—WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

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VERTICAL BORING MILLS

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ATTRACTIVE PRICES

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HERBERT CARBICUT Lathe.
BULLARD 24in. Vertical Borer.
PEARNS-RICHARDS Horiz. Boring and Facing Machine. 32in. facing head. 17ft. bed.
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SCRIVENER No. 1 Centreless Grinder.
CHURCHILL 10in. × 20in. Hydraulic Plain Cylindrical Grinder.
RAPIDOR 6in. H.D. Hacksaw.
TOLEDO 45-ton Inc. 4in. str. Power Press.
New **RATZER** 12-ton Inc. Ungeared Power Press.
BESCO 8ft. × ¼in. Overcrank Guillotine.
CINCINNATI Plain Mill, 60 × 12 table. Mot.
CINCINNATI Model 3-24 Hydromatic Horizontal Milling Machine.
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Dean, Smith & Grace 10in. × 40in. between Centres S.S. & S.C. Lathe Serial No. 23202. Built-in flange type motor Completely rebuilt.

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One Geisler Dynamic Balancing Machine. Model G, 1939. Offers to BOX C553, MACHINERY, Clifton House, Euston Road, N.W.1.

Deutsche Niles 17½in. S.S. & S.C. Lathe.

Fully motorised through independent motors, rapid traverse to saddle, Norton type gearbox, taper turning attachment, travelling steady. square toolbox, 40in. chuck.
Swing over the bed 35in.
Distance between centres 11ft. 6in.
Swing in the gap 42in. × 17in.
27 spindle speeds 3.2 to 383 r.p.m.
36 Whitworth threads, 2 to 28.
30 metric threads, 1 to 14 mm.
Main motor drive 25 h.p.

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Milling Machines

Cincinnati No. 2 Vertical
Cincinnati No. 2. Universal
Cincinnati No. 4-48 Production
Milwaukee No. 2. Universal.
Parkson 3J Horizontal
Herbert 15S & 18V Verticals
Archdale 30in. Vertical

THE CAUSEWAY, EGHAM, SURREY
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By Order of the Trustees of WILLIAM ARTHUR HOOTON, deceased.

GREAT EASTERN STREET, NOTTINGHAM.

HENRY BUTCHER & CO.

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POWER PRESSES UP TO 30 TONS.
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MILLING and DIE SINKING MACHINES by "TAYLOR, TAYLOR & HOBSON."
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AIR COMPRESSORS, SPOT WELDERS and TRANSFORMERS.
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Plant for Sale continued on Page 162

Classified Advertisements (*PLANT FOR SALE, contd.*)

NEW MACHINE TOOLS FROM STOCK

GRANOR OF HALIFAX 28in. stroke Heavy Duty Shaping Machine. 400-440/3/50.

EARLY DELIVERY

MITCHELL OF KEIGHLEY 8½in. Type DM8 Gap Bed Lathe, by 5ft. 3in. B.C. 400-440/3/50. January, 1961 delivery.
MITCHELL OF KEIGHLEY 10½in. Type DM10 Gap Bed Lathe by 5ft. 5in. between centres. 400-440/3/50. December delivery.
MITCHELL OF KEIGHLEY 12½in. Type DM12 Gap Bed Lathe by 6ft. 9in. B.C. 400-440/3/50. April delivery.
VICTORIA No. 2 Rapidmil Universal Milling Machine, table size 48in. × 11½in. 400-440/3/50. December delivery.
VICTORIA No. V2 Vertical Milling Machine. Table size 45in. × 11in. 400-440/3/50. Instant delivery.

CENTAUR TOOL WORKS,
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SENIOR SALES ENGINEER

FOR

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Importer and Manufacturer OF HIGH CLASS AMERICAN & SWISS MACHINE TOOLS

Applicants should be between 30 and 40 years and have served apprenticeship.

Post carries excellent prospects for right man.

Write, in confidence, giving fullest information to—

Box C 456 MACHINERY,
Clifton House, Euston Road, N.W.1

SITUATIONS VACANT

If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed but you will not be notified as this would disclose the identity of the advertiser.

Production Engineer Experi- enced in workshop practice, operation planning, shop layout, time study, jig and tool design required by General Engineering Works in Leicestershire employing over 500. Applicants should be apprentice trained, technically qualified to H.N.C. level and in the age group of 35 to 45. This is an executive appointment with life assurance and superannuation benefits in an expanding company.—Apply in confidence giving details of age, qualifications, present position and salary expected to BOX C445, MACHINERY, Clifton House, Euston Road, N.W.1.

Working Press Shop Foreman required experienced in setting hand and power presses up to 22 tons and production drilling and milling machines. Applicant must be energetic and production minded.—Permanent position.—Apply RODWELL, Athlon Road, Alperton, Wembley, Middlesex. ALP. 2131.

Toolroom Foreman (35/45 Years) required for small toolroom of light engineering company situated in West Lothian. Applicants must be good disciplinarians and experienced in training apprentices. Superannuation scheme.—Write giving full details of experience, education, age and salary required, to Personnel Manager, BOX TF4605, AK. ADVG., 212a, Shaftesbury Avenue, London, W.C.2.

Machine Tool Sales (London) LTD., require services of young man (Engineering Degree preferred), take charge customers' spares service, mail circularising, contact with agents, technical write-ups, etc. French and Italian advantage. London office. Five-day week. Starting salary around £800 plus LVs.—Write: 79, Portland Place, London, W.1.

Auto Setter. First Class Man required for Index and B. & S. machines. An excellent rate will be paid to the right man. Contributory Pension Scheme is in operation. No night work. W. London area. Write giving fullest details of experience.—BOX C448, MACHINERY, Clifton House, Euston Road, N.W.1.

WORK STUDY ENGINEER

A young enthusiastic Work Study Engineer with experience in Light Engineering is required to initially work in the Machine Building subsidiary of a group of Textile Companies. There is eventual scope to develop Work Study Techniques over a much wider range of application.

COMMENCING SALARY £900 p.a.

Apply to the Personnel Manager
The Klinger Mfg. Co. Ltd.
Silver St., Edmonton, N.18

Engineering Shop Foreman

required. Applicaut mnst be capable of controlling 25 skilled Millers and Machine Tool Fitters engaged in building a variety of Light Special Purpose Machines. He should also be experienced in planning and estimating. Position is of senior monthly staff status. Housing available.

Write :

STABILITY RADIO COMPONENTS LTD.
Cranes Farm Road, Basildon, Essex

Sales Engineer for Continental high-production and special-purpose machines for Birmingham area. Resident Birmingham or district.—Please send applications with full details, BOX C436, MACHINERY, Clifton House, Euston Road, N.W.1.

A JIG & TOOL DRAUGHTSMAN

is required by

W. H. ALLEN SONS & CO. LTD.

An experienced Jig and Tool Draughtsman over 30 years old with ability and enthusiasm and holding at least an Ordinary National Certificate is needed. Interesting work, a Contributory Pension and free Life Assurance scheme, together with financial assistance towards moving are available.
Applications, in writing, giving full details of age, qualifications, experience and salary to:

THE PERSONNEL MANAGER
(Ref. 1606E/2/2)
QUEENS ENGINEERING WORKS,
BEDFORD.

BRANDAUER *of* Birmingham

Require a toolroom foreman to control a sectionalised toolroom which has been extensively re-equipped during the last four years. Staff consists of approximately 30 machinists and toolmakers, backed by a toolroom manager and designers. Candidates must have drive, initiative, leadership and be fully conversant with ultra precision follow-on and compound tools. This Company is producing large quantities of high precision pressings for the electronics industry. The successful candidate will have an interesting and progressive career at an attractive salary. Write in the first instance stating experience to date to:

C. BRANDAUER & CO. LTD,
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Plano-Miller Operator Wanted. Experienced on large machines. Good wages and conditions. Temporary housing available while permanent accommodation is being obtained.—Apply with full details to CHARD MACHINERY MANUFACTURING CO., LIMITED, Tapstone Lane, Chard, Somerset.

Classified Advertisements (*SITUATIONS VACANT contd.*)

ROCKWELL MACHINE TOOL COMPANY LIMITED

Have a vacancy at their Midland Office for an

OUTSIDE SALES ENGINEER

to handle high grade British and imported Machine Tools. Applicants should have some engineering background, good knowledge of Machine Tools and preferably experience of working in the Birmingham, Wolverhampton and Black Country areas.

Reply stating age, experience and salary required.
To:—

1/5 Cateswell Road,
Hall Green,
BIRMINGHAM, 28.
Telephone: Springfield 1134/5

SENIOR FOREMAN

Old-established and expanding Engineering Company requires to fill the senior staff position of Machine and Fitting Shop Superintendent in its Works East of Manchester. This vacancy will arise shortly due to retirement of member of staff with long service in this position. Applications invited from Engineers holding similar positions and with first-class workshop experience on a wide range of medium-weight general engineering products, able to initiate and apply modern production methods. Age between 35 and 45. This post calls for real initiative and hard work for which commensurate remuneration is offered together with good staff employment conditions. Full details, which will be afforded strictest confidence, to:

BOX C457, MACHINERY,
Clifton House, Euston Road, N.W.1.

TECHNICAL JOURNALIST

for Publicity Department of large Machine-Tool Makers situated in the Midlands.

Applicants preferably with machine-shop background with flair for writing. 25-30 years of age.

Contributory pension scheme in force. Salary, up to £1,000 depending on experience.

Applicants to **BOX C477, MACHINERY**
Clifton House, Euston Road, N.W.1

Machine Tool Sales Engineer and Correspondent required.—Please write stating age, experience and salary required, to the MANAGER, BUCK & HICKMAN LTD., Otterspool Way, Watford By Pass, Watford, Herts.

Sales Engineer Required by Manufacturers and Distributors of Machine Tools to take charge of Birmingham office. Applicants must reside on the territory and be aged between 30 and 42. Must possess sound engineering knowledge and have previous successful selling record in this field. Basic salary up to four figures, dependent upon qualifications plus bonus or commission. Superannuated post. Car supplied. Lunch allowance. Present staff advised.—BOX C475, MACHINERY, Clifton House, Euston Road, N.W.1.

Engineer Required to Demon-strate and service a wide range of machine tools. Knowledge of electrics advantageous. Applicants should preferably be based in London. Position involves travelling throughout the British Isles and occasionally in Europe. —BOX C473, MACHINERY, Clifton House, Euston Road, N.W.1.

The Colchester Lathe Co. Ltd.,
wishes to appoint

OVERSEAS SALES & SERVICE ENGINEERS

As a result of the ever-increasing world demand for Colchester Lathes additional highly-qualified men are required to visit our overseas markets at regular intervals.

Applicants should be between 30 and 40 years of age, with a sound practical engineering and commercial background, and should preferably be currently employed in the machine tool industry. Fluent German or Spanish would be an advantage, and applicants must be prepared to travel extensively.

Attractive salaries are offered to men with the right qualifications and there is ample scope for progress in a lively and expanding organisation. The company operates an excellent pension scheme.

Written applications, together with a recent photograph, should be addressed to:

THE SALES DIRECTOR
THE COLCHESTER LATHE CO. LTD.,
COLCHESTER ESSEX

Highly Paid, Secure and Interest-ing posts are always available for technically trained men. Find out how you can put some letters after your name by preparing at home on "No Pass—No Fee" terms, A.M.I.Mech.E., A.M.I.Prod.E., A.M.S.E., City and Guilds, etc., etc. Full details of exams and hundreds of courses in all branches of Engineering., Draughtsmanship, Management and Automation Techniques, the benefits of our Employment Dept., and unique record of 95 per cent successes are given in "Engineering Opportunities"—a valuable 148-page Guide which will reveal many chances you are now missing.—Write for your copy today (stating subject of interest).—FREE and without obligation, B.I.E.T. (Dept. 43a), 29, Wright's Lane, London, W.8.

General Machine Shop Manager for small precision engineering Company situated on the outskirts of North London. Good prospects to right man, who must not be afraid of hard work. Applicant must have served a toolroom apprenticeship and had practical experience in the complete running of a small works and capable of controlling mixed staff. Planning, tooling, estimating, buying, bonus rates, sub-contracts, customer liaison, government contracts procedure, A.I.D., etc., etc. State salary required and copies of references.—BOX C412, MACHINERY, Clifton House, Euston Road, N.W.1.

Technical Sales Engineer Re-quired for versatile hydraulic presses. Must have wide knowledge of press work. Car, salary, commission.—BOX C462, MACHINERY, Clifton House, Euston Road, N.W.1.

SENIOR SALES ENGINEER

REQUIRED BY

IMPORTER & MANUFACTURER
OF
HIGH CLASS MACHINE TOOLS
Especially for Steel Industry

Appointment will cover visits to Steel Companies throughout U.K. involving discussions at high technical level. Engineer experienced in this field preferred. Age between 27 and 40.

Write, in confidence, giving fullest information to—

Box C 455 MACHINERY,
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MANAGER
PRODUCT PLANNING & TECHNICAL SERVICES

This vital and interesting position is to develop and co-ordinate future product planning, and to advise ancillary departments on technical matters—with special reference to co-ordinating and progressing Special Sales Enquiries.

Preference will be given to candidates with minimum of 3-5 years' experience of product planning, although 3-5 years' experience of truck engineering or equivalent would be considered. Minimum educational standards—H.N.C. with 5-year indentured apprenticeship in automotive engineering.

This important post will carry an attractive salary and a valuable career opportunity. Detailed applications, quoting "Ref. 63", to the

Personnel Manager,
CHRYSLER MOTORS LTD.,
Kew Gardens, Surrey.

A. DOUGLAS CO., LTD.
wish to hear from
SKILLED SERVICE ENGINEERS

who may be interested in a position combining showroom demonstrations and technical duties in our Sales Department. A pleasing disposition is essential. Minimum age 28. The position offers participation in a profit sharing scheme after three months' service. Write:

LINCOLN ROAD,
CRESSEX INDUSTRIAL ESTATE,
HIGH WYCOMBE, BUCKS.
OR TELEPHONE HIGH WYCOMBE 4390

Ministry of Aviation Requires Assistant Technical Cost Officers for posts based in Central London and Mottingham, S.E.9, to prepare estimates of prime costs of manufacture of engineering productions. Considerable travelling. Qualifications: Recognised engineering apprenticeship, O.N.C., C. & G. Final certs. or equivalent. Good experience in ratefixing, planning and prime cost estimating. Machine shop experience an advantage. Vacancies in sections dealing with high class mechanical and electrical engineering productions, aircraft, instruments, electronic equipment. Salary, £975-£1,115. Good prospects for promotion and pension.—Application forms from MANAGER (PE 2530), MINISTRY OF LABOUR, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4.

Sales Engineer Required by Large manufacturers and distributors of Machine Tools to take charge of a new office to be opened in Leeds. Applicants should have practical experience of Machine Tools and previous selling experience in this field. Must be prepared to reside in or around Leeds. Age between 30 and 45. Car provided. Superannuated post. Good prospects and salary. Present staff advised.—Reply in first instance to Sales Manager, BOX C454, MACHINERY, Clifton House, Euston Road, N.W.1.

REPRESENTATIVES

Technical Representative wanted for Sheet Metal Machines and Machine Tools. N.W. London and Home Counties area. Non-contributory Pension and Assurance Scheme.—Details of experience and salary required to MANAGING DIRECTOR, F. J. EDWARDS LTD., 359, Euston Road, London, N.W.1.

ROCKWELL MACHINE TOOL COMPANY LIMITED

Have a vacancy at their London Head office for a

TECHNICAL CORRESPONDENT

to deal with correspondence in connection with sales of high grade Machine Tools. Essential qualifications are a Machine Tool background, initiative and some commercial experience. Knowledge of press shop equipment and/or German advantageous, but not essential. Good working conditions; non-contributory pensions scheme in operation after qualifying period.

Apply to:—

Welsh Harp,
Edgware Road,
LONDON, N.W.2.
Telephone: GLAdstone 0033.

MIDLAND MACHINE TOOL TECHNICAL REPRESENTATIVE

An excellent opportunity occurs for a Sales Engineer to join a well-established and expanding Company handling a first-class range of specialised Continental Machine Tools. The position carries a good basic salary, commission and expenses, and a car will be provided. Applicants should reside in the central midlands, have a good technical and practical background and be used to working on their own initiative. Interviews by arrangement in Birmingham or London.

Apply: **EMBASSY MACHINE & TOOL CO. LTD.**
248, Watford Way, London, N.W.4

RECEIVED TOO LATE FOR CLASSIFICATION

PLANT WANTED

SITUATIONS WANTED

Engineering Executive. Age 43. Desires post in Home Counties. Excellent industrial background. Interested in all propositions requiring integrity, drive and initiative.—BOX C451, MACHINERY, Clifton House, Euston Road, N.W.1.

University Trained. Asst. Chief Jig and Tool Draughtsman. Frustrated and disgusted in present post, seeks change. Similar or chief's position required. 20 years' experience production engineering includes Process planning, Machine tool selection and purchase. Wide and varied knowledge and experience. Minimum salary required £1,500.—BOX C460, MACHINERY, Clifton House, Euston Road, N.W.1.

Design Engineer, 34, at Present employed by Consultant Engineers, seeks senior position. Strict disciplinarian. Preferred area N.E. Middlesex or adjacent. Salary required £1,000 per annum.—BOX C478, MACHINERY, Clifton House, Euston Road, N.W.1.

PLANT WANTED—contd.

Production Machinery, Single and multi-spindle autos, 20-200 ton presses, Ward and Herbert capstans.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

Single Spindle H/S Motorised autos, capacities ⅜in. to 2¼in., must be in first class condition, fullest details with serial nos. price, location, etc.—BOX C482 MACHINERY, Clifton House, Euston Road N.W.1.

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Immediate Grinding Capacity available. High Precision work on all materials. Tungsten Carbide Grinding a speciality. Manufacturers of "Special" Tipped Tools.

THE NEW ZIPPER CO., LTD.,
72B, Buckingham Avenue, Slough Trading Estate, Bucks. Tel.: 25612.

MATERIALS FOR SALE

Approx. 5 Cwt. Scrap Pure nickel strip. What Offers.—BOX C474, MACHINERY, Clifton House, Euston Road, N.W.1.

WANTED URGENTLY

Vertical Boring Mill,
36in. swing, 5 station turret.

Hobbing m/c.
Gears and splines length 3ft. 6in., dia. 13in.

Jig and tool capacity.

Cleveland 2in. or 2½in.
'B' type 18in. stack feed.

Full details including capacity, feeds, speeds, year of manufacture, Serial No., make, equipment, location and price required to:

BOX C472, MACHINERY,
Clifton House, Euston Road, N.W.1.

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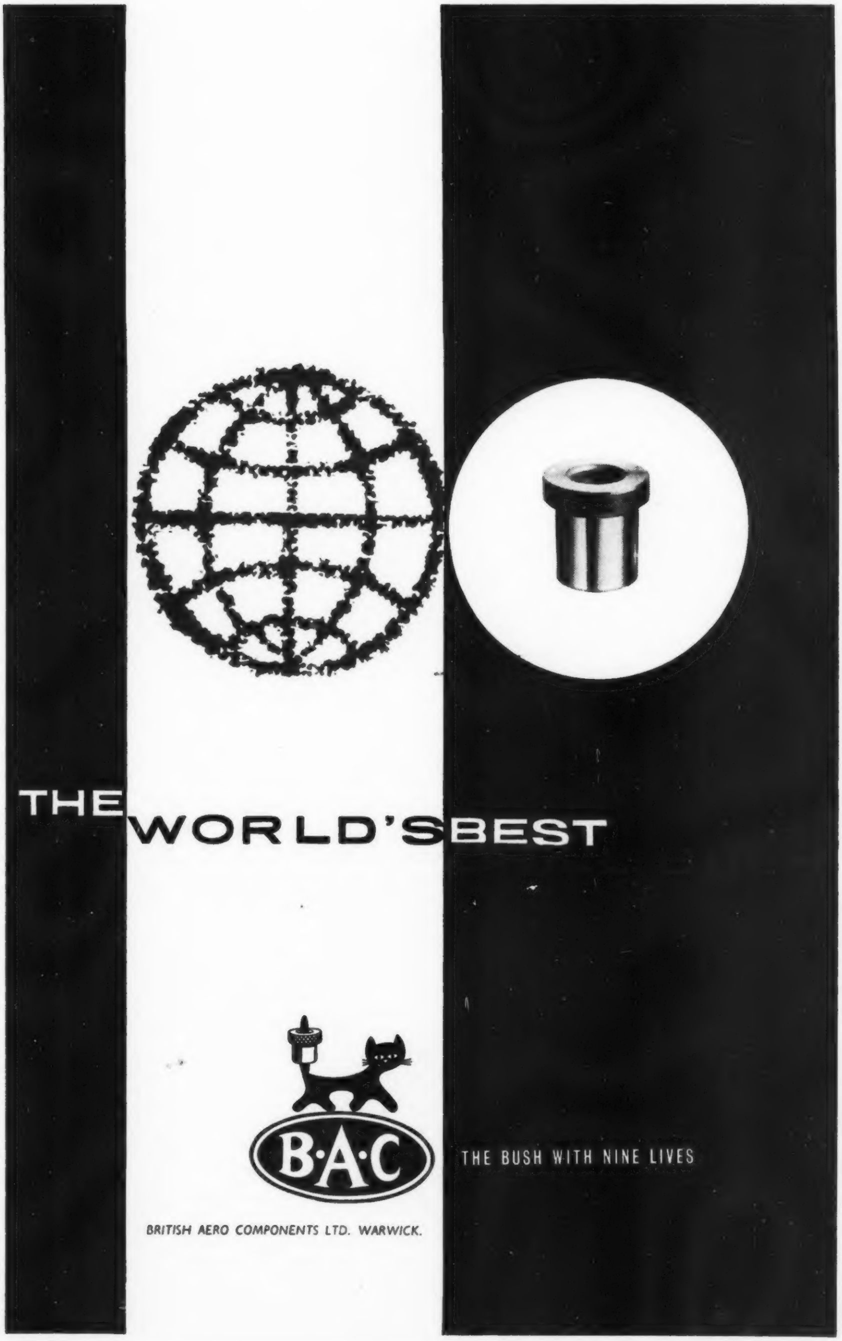

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